AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

# Welding Design & Fabrication

ESTABLISHED IN 1930 AS INDUSTRY & WELDING

OCTOBER 1961
Metal Show Issue

STEVENS RICE
UNIVERSITY MICROFILMS
313 N 1ST ST
ANN ARBOR MICH 4 R73

## A MACHINE TOOL TREND:

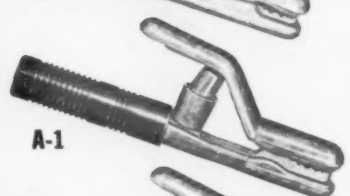
## Weldments Are Replacing Castings

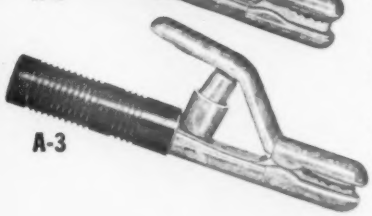
# "Pick The Jackson Holder That Suits The Job!"

The *right* holder will speed the work, boost weld quality, and cut welder fatigue.

The right holder is one that's big enough to carry the required work load (determined by amperage, rod dia. and duty cycle), without burdening the welder with unneeded weight. The right holder for your work is one of the fourteen quality Jackson Holders listed below.

## HIGH-PRODUCTION HOLDERS

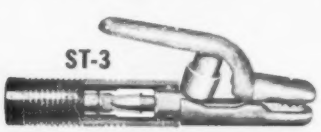


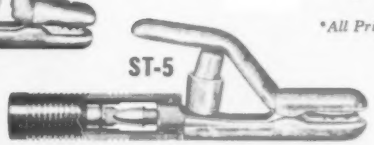




| MAXIMUM CAPACITY AMPS | ROD | MODEL NO. | PRICE* | DESCRIPTION | |
|---|---|---|---|---|---|
| 200 | 5/32" | JH-1 | $4.50 | High-Production Holders (See Duty Cycle Table) | COPPER ALLOY |
| 300 | 5/32" | AW-C | 6.60 | | |
| 350 | 1/4" | A-1 | 7.15 | | |
| 450 | 3/8" | A-3 | 8.90 | | |
| 500 | 3/8" | A-3S | 9.20 | | |
| 300 | 1/4" | ST-3 | 7.90 | As above, with Sealed-Tight Connection | |
| 450 | 3/8" | ST-5 | 9.20 | | |
| 300 | 1/4" | A-W | 7.80 | Featherlight Holders | ALUMINUM ALLOY |
| 400 | 5/16" | A-5S | 9.10 | | |
| 200 | 5/32" | JH-2 | 7.50 | Streamlined Featherlight Holders | |
| 300 | 1/4" | JH-3 | 8.60 | | |
| 300 | 1/4" | B-1 | 5.15 | Economy Holders | 98% COPPER |
| 450 | 3/8" | B-3 | 6.65 | | |
| 400 | 5/32" | B-4 | 5.00 | | |

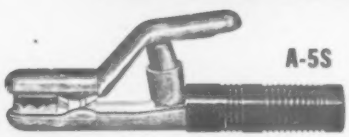
*All Prices Lower in Quantities*

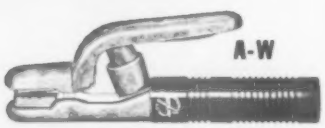
## SEALED TIGHT HOLDERS



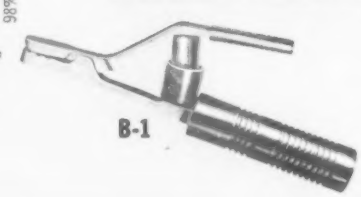

## FEATHERLIGHT HOLDERS




## STREAMLINED HOLDERS

## ECONOMY HOLDERS




HIGH-PRODUCTION HOLDER DUTY CYCLES

| HOLDER CLASS | MODEL NUMBER | ELECTRODE DIAMETER | AMPERAGE | CABLE SIZE | DUTY CYCLE |
|---|---|---|---|---|---|
| SMALL | JH-1 | 5/32" | 150<br>200 | 2<br>1 | 50% |
| MEDIUM | AW-C | 7/32" | 250<br>300 | 1<br>1/0 | 50% |
| | A-1 & ST-3 | 1/4" | 300<br>350 | 1/0<br>2/0 | 50% |
| LARGE | A-3 & ST-5 | 3/8" | 375<br>450 | 2/0<br>3/0 | 65% |
| EXTRA LARGE | A-3S | 3/8" | 500 | 4/0 | 80% |

*Sold Everywhere by Better Welding Supply Distributors*

## Jackson Products

AIR REDUCTION SALES CO., A DIVISION OF AIR REDUCTION CO., INC.

5523 Nine Mile Road, Warren, Michigan

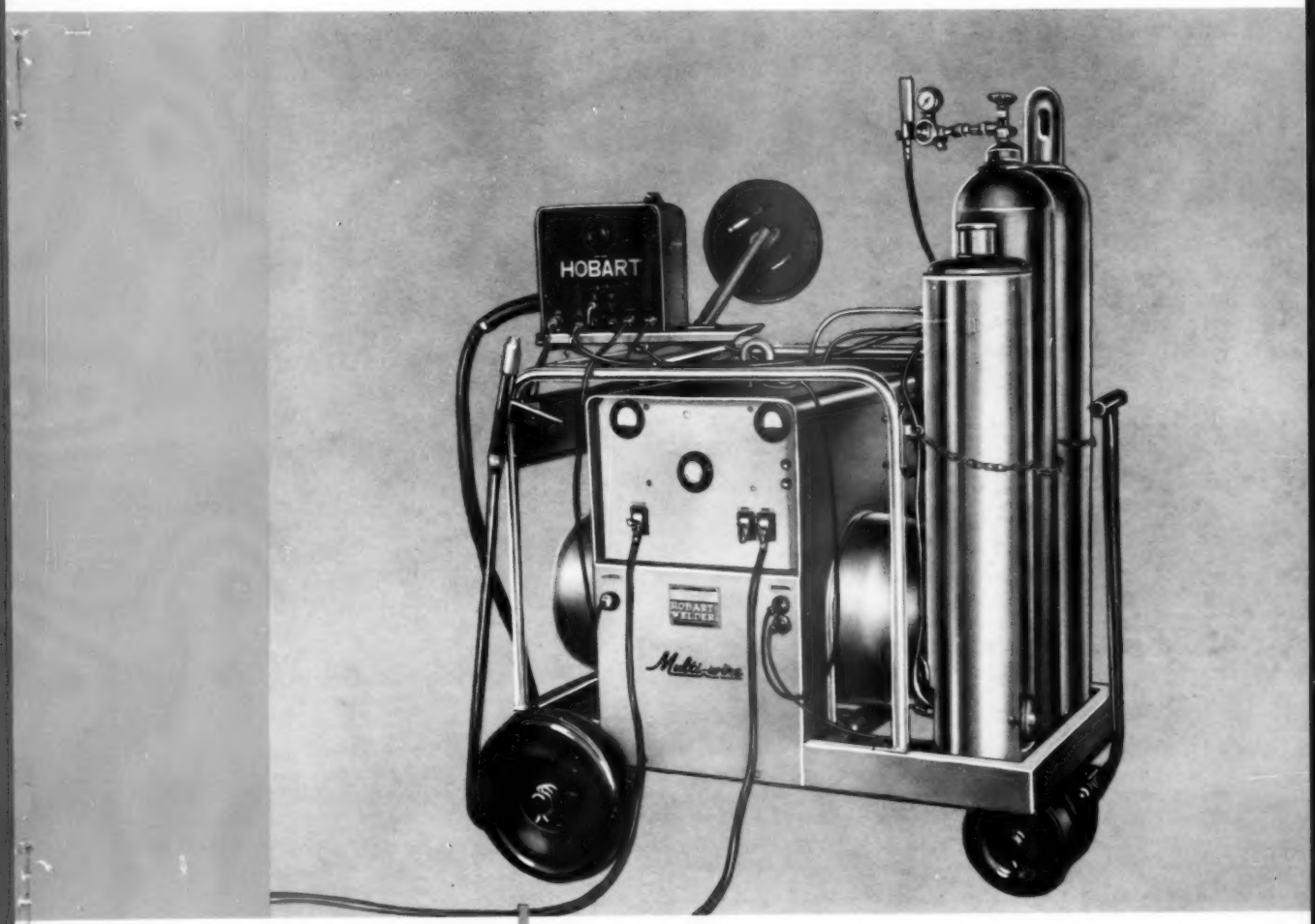
**For More Information Circle No. 58 on Reader Service Card.**

**Circle No. 54 on Reader Service Card. ⟶**

# HOBART MULTI-RANGE arc welders

HOBART WELDERS · ELECTRODES

## *Multi-wire* FOR AUTOMATIC WIRE FEED WELDING PROCESSES




*Multi-wire* welding semi-automatic processes are used for joining metals both light gauge and heavy sections using portable, light-weight equipment.

### *Multi-wire* THE "ALL-PURPOSE" WELDER

A compact welding "package" with the ultimate in flexibility. With the new Hobart *Multi-wire*, welding can be done on steel and non-ferrous metals using the following semi-automatic processes.

(1) Micro-wire, the small wire, all position, gas-shelded welding process.
(2) Large diameter wires for CO2 welding.
(3) Tubular wire (FabCO) and CO2 welding.
(4) Metal inert gas welding (MIG).
(5) Tubular wire without shielding gas.
(6) Submerged arc welding.

**HOBART "WORLD'S MOST COMPLETE LINE OF ARC WELDING EQUIPMENT"**

## MODEL PKMC-502

# COMPLETE

# *Multi-wire* PACKAGE

Standard Package includes . . .

**MCV-502 Motor-Generator Welder**

**No. 349 Voltmeter and Ammeter**

**SMA-26 Migarc with fitted control cables, with fitted welder-to-Migarc and 15′ welder-to-ground AWG 4/0 Cables**

**No. 1262 $CO_2$ Pistol-Grip Straight-Line Waterless Gun and 10′ Cable**

**No. 108C Carryall with swivel mounting for Migarc wire feeder**

**Complete Package: Approximate weight 1435 lbs. Dimensions: 61″ long, 39″ wide, 71″ high.**

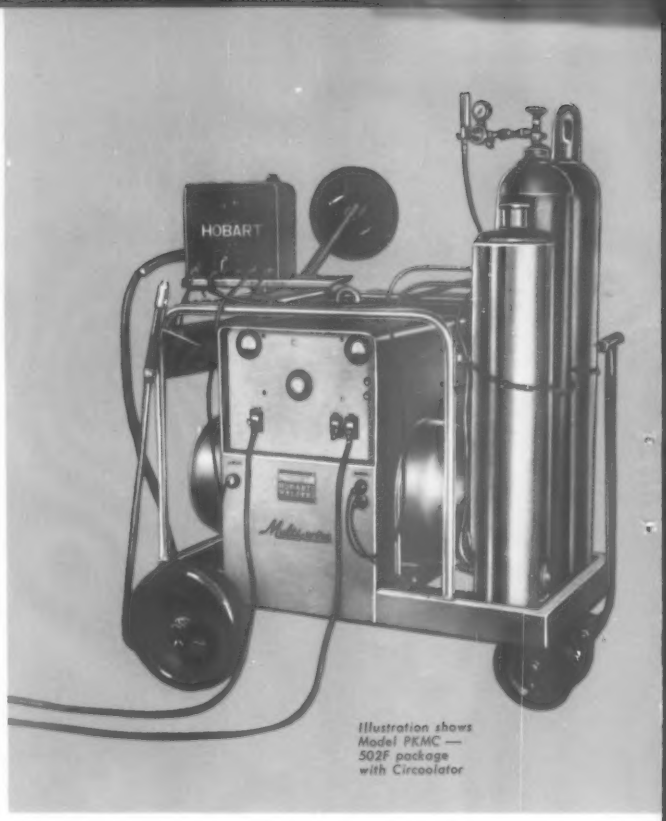



*Illustration shows Model PKMC — 502F package with Circoolator*

## WELDER: (MCV-502)

The constant voltage type motor-generator is rated 500 amperes, 40 volts, continuous duty cycle (650 amperes at 60% duty cycle) with an open-circuit voltage range of 3 to 48 volts. The generator is separately excited. A single motor switch is all that is required to disconnect entire unit when not in use. The welder motor is rated 25 horsepower, 3 phase, 220/440 volts, 60 cycles, 1750 rpm. (A 50 cycle model is available at 1450 rpm). A single rheostat provides for continuous voltage tuning. For optimum welding conditions for various applications, slope characteristics of the unit are adjustable for 3 different welding slopes (steep, medium, and flat) by merely changing the electrode cable among 3 studs. Slope is provided by means of ballast resistance in the output circuit. A contactor in the output of the generator is controlled through the gun switch. A separate 110 volt A.C. receptacle is provided for power to operate the wire feeder and Circoolator (optional) or small power tools. Approximate weight 1,000 lbs. Complete. Dimensions 53½″ long, 30″ wide, 39″ high. (A model RCS-500 — 500 amp. Rectifier Welder is also available).

## WIRE FEEDER: (SMA-26)

This light weight compact wire feeder is so constructed that it may be removed from swivel mounting and taken to remote locations for welding. All electrical components are easily accessible and operated from one convenient control panel. An inching button is provided for easy wire threading. The unit also comes with shut-off type gas valve and a contractor relay and receptacle. The welding operator has trigger control over gas flow, wire feed and the welding current contactor right at the work. A dynamic braking circuit is provided that results in immediate stopping of the feed wire after the operator releases the gun trigger switch. This Micro-wire unit is designed for feeding wire in a range of 34 to 340 inches per minute at a gear ratio of 75 to 1 (other gear ratios available). Approximate weight 80 lbs. Dimensions 20″ long, 12″ wide, 14½″ high.

## GUN AND CABLE: (No. 1262)

For the standard Multi-wire package, the No. 1262 $CO_2$ Pistol-Grip Straight-Line Waterless Gun and 10′ Cable Assembly is provided. This assembly handles the following hard wires: .045″ (cable liner required), 1/16″, 5/64″, or 3/32″. Tubular wires. 5/64″, 3/32″, 7/8″, or 1/8″. For 1/8″, a gearbox ratio 150:1 is recommended.

## CARRYALL: (No. 108C)

This all-welded steel constructed Carryall will carry MCV-502 Welder, wire feeder with swivel mounting, two gas cylinders, and water Circoolator (optional equipment). Sturdy, steel wheels are provided.

## SPOOLED WELDING WIRE:

Write for complete information on sizes and types to meet your particular requirements.

## GAS SUPPLY AND REGULATION:

Welding grade (dry) gases, manifolds etc., can be secured from your local supplier.

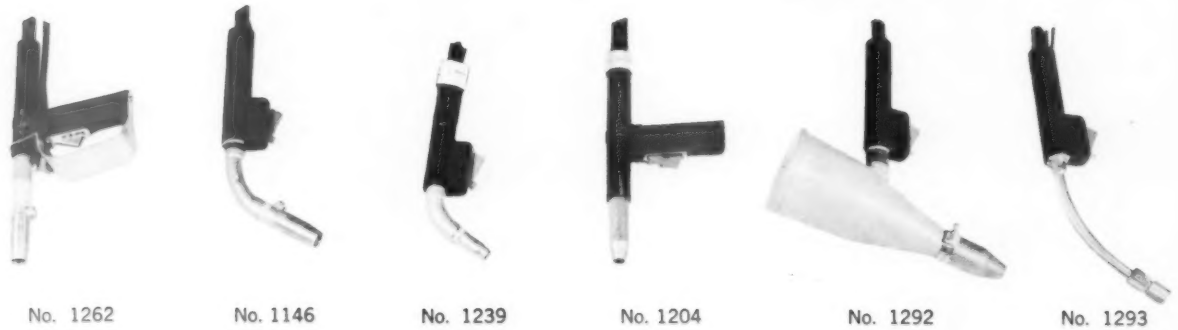
# Multi-wire

## a semi-automatic welding process

### featuring easily interchangeable accessories to adapt it to the different welding processes.

**Provisions are made to provide a power source with a choice of characteristics to match all of the semi-automatic processes. A wire feeder that will fall into the normal wire-speed ranges for these processes, with provisions for either spooled or coiled wire. A choice of welding cables and guns. A water cooling system and — a portable Carryall system that provides mounting for all components.**

UNIVERSAL GUN AND CABLE ASSEMBLIES **for use with *Multi-wire* package**



No. 1262 | No. 1146 | No. 1239 | No. 1204 | No. 1292 | No. 1293

No. 1262 $CO_2$ Pistol Grip Straight-Line Gun and Cable, 500 amperes maximum. Waterless. For .045", 1/16", 3/64", 3/32", 1/8" hard or tubular wires.

No. 1146 $CO_2$ Gun and Cable, 500 amperes maximum. Waterless. For .045", 1/16", 3/64", 3/32" hard wires.

No. 1239 Micro-Wire Gun and Cable, 200 amperes maximum. Waterless. For .030", .035", and .045" hard wires.

No. 1204 Water Cooled Pistol Grip Gun and Cable, 300 amperes maximum. Water cooled for .045", 1/16", 3/64", 3/32", and 1/8" hard or tubular wires; for .045", 1/16", and 3/32" soft wires.

No. 1292 Submerged Arc Flux Gun and Cable, 500 amperes maximum. Waterless. For 1/16", 3/64", and 3/32" hard wires.

No. 1293 Open Arc Gun and Cable (no gas shielding), 500 amperes maximum. Waterless. For 3/32" and 7/64" tubular wire (particularly for hard surfacing).

CIRCOOLATOR:
(No. 1287) Optional

This Circoolator offers highest cooling capacity with minimum volume of water. It is conveniently shaped to fit into the space normally occupied by a large cylinder. A high efficiency, extremely quiet pumping unit is located in the base of the tank. This unit can be plugged into the front of the welder without special plumbing or valves.

To: HOBART BROTHERS CO., BOX HW-101, TROY, OHIO

I'm interested in:

- ☐ MULTI-WIRE the complete welder package that handles six different semi-automatic welding operations by simply interchanging components — 500 ampere size.
- ☐ MICRO-WIRE the complete welder package for small diameter wire welding — 200 ampere size.
- ☐ Send information and prices.
- ☐ Have your representative stop in .....

Company name .....

Your name ..... Position .....

Street .....

City ..... Zone ..... State .....

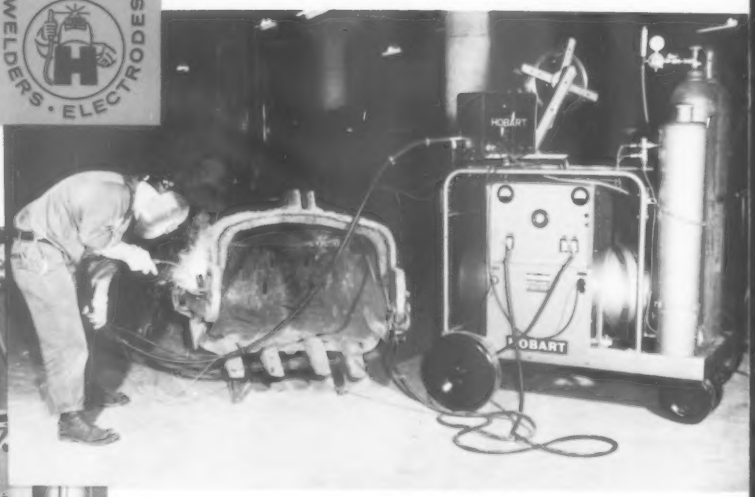
☐ Send me a complete welding machine catalogue.

# *Multi-wire* for $CO_2$ GAS METAL ARC • SUBMERGED ARC • INERT GAS METAL ARC • TUBULAR ARC WELDING

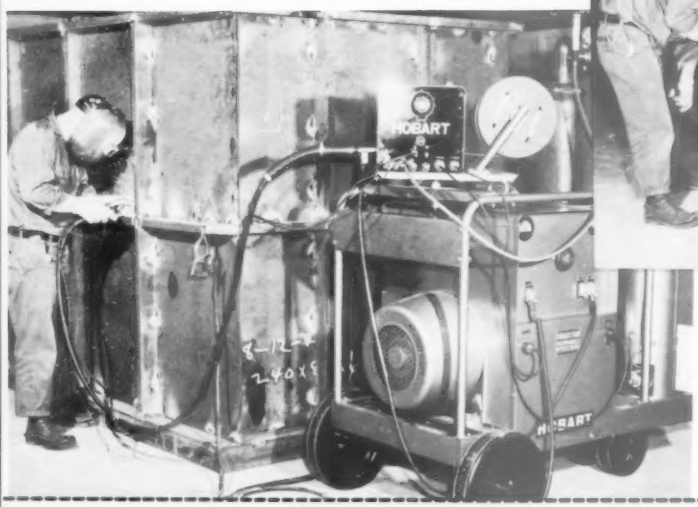
Tubular fluxed wire and $CO_2$ gas process.

Submerged arc welding.

HOBART WELDERS • ELECTRODES




Open arc hardsurfacing.




Straight $CO_2$ semi-automatic welding with large diameter wire.

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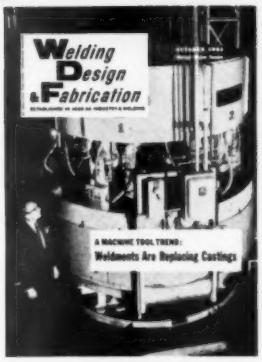


*for October, 1961*

**COVER:** The man and the machine are symbolic of an important trend taking place in the machine tool industry; Tool builders are specifying weldments instead of castings for key parts. John A. Bradner, chairman of the board, Lees-Bradner Co., Cleveland, stands beside a product of the change: A 26-ton, 6-station gear hobbing machine that is out-producing its neighbors in a large, midwestern plant, two to one. Our interview with Mr. Bradner, beginning on page 49, discloses the reasons for the change.

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# BRAZING ALLOY REFERENCE CHART

## SILVALOY BRAZING ALLOYS

| SILVALOY | NOMINAL COMPOSITIONS | | | | | Solidus °F | Liquidus °F | Density troy oz /cu in |
|---|---|---|---|---|---|---|---|---|
| | Ag | Cu | Zn | Cd | Other | | | |
| 5 | 5 | 88.75 | 0 | 0 | P=6.25 | 1190 | 1300 | 4.37 |
| 15 | 15 | 80 | 0 | 0 | P=5 | 1190 | 1300 | 4.45 |
| 35 | 35 | 26 | 21 | 18 | | 1125 | 1295 | 4.90 |
| 45 | 45 | 15 | 16 | 24 | | 1125 | 1145 | 4.92 |
| 50 | 50 | 15.5 | 16.5 | 18 | | 1160 | 1175 | 5.00 |
| 503 | 50 | 15.5 | 15.5 | 16 | Ni=3 | 1170 | 1270 | 5.00 |
| 355 | 56 | 22 | 17 | 0 | Sn=5 | 1145 | 1205 | 5.00 |
| I-401 | 5 | 0 | 16.6 | 78.4 | | 480 | 600 | 4.53 |
| 377 | 5 | 0 | 0 | 95 | | 640 | 740 | 4.60 |
| A-4 | 9 | 53 | 38 | 0 | | 1410 | 1565 | 4.50 |
| 20 | 20 | 45 | 30 | 5 | | 1140 | 1500 | 4.64 |
| A-11 | 20 | 45 | 35 | 0 | | 1315 | 1500 | 4.68 |
| A-79 | 25 | 52.5 | 22.5 | 0 | | 1250 | 1575 | 4.71 |
| A-13 | 30 | 38 | 32 | 0 | | 1370 | 1410 | 4.67 |
| 250 | 40 | 30 | 28 | 0 | Ni=2 | 1220 | 1435 | 4.76 |
| 254 | 40 | 30 | 25 | 0 | Ni=5 | 1220 | 1580 | 4.72 |
| A-14 | 40 | 36 | 24 | 0 | | 1235 | 1415 | 4.80 |
| 105 | 45 | 30 | 12 | 0 | Mn=13 | 1298 | 1298 | 4.76 |
| A-18 | 45 | 30 | 25 | 0 | | 1225 | 1370 | 4.82 |
| A-25 | 50 | 34 | 16 | 0 | | 1250 | 1425 | 4.99 |
| 54 | 54 | 40 | 5 | 0 | Ni=1 | 1340 | 1575 | 5.06 |
| A-33 | 60 | 25 | 15 | 0 | | 1245 | 1325 | 5.02 |
| 60 | 60 | 30 | 0 | 0 | Sn=10 | 1115 | 1325 | 5.23 |
| T-50 | 62.5 | 32.5 | 0 | 0 | Ni=5 | 1435 | 1590 | 5.19 |
| Easy | 65 | 20 | 15 | 0 | | 1240 | 1325 | 5.06 |
| Medium | 70 | 20 | 10 | 0 | | 1275 | 1360 | 5.14 |
| 301 | 72 | 28 | 0 | 0 | | 1435 | 1435 | 5.24 |
| AE-102 | 72 | 27.8 | 0 | 0 | Li=.2 | 1410 | 1410 | 5.22 |
| K-427 | 75 | 0 | 25 | 0 | | 1300 | 1345 | 5.06 |
| T-51 | 75 | 24.5 | 0 | 0 | Ni=.5 | 1435 | 1475 | 5.30 |
| Hard | 75 | 22 | 3 | 0 | | 1365 | 1450 | 5.28 |
| T-52 | 77 | 21 | 0 | 0 | Ni=2 | 1435 | 1525 | 5.32 |
| A-49 | 80 | 16 | 4 | 0 | | 1345 | 1490 | 5.29 |
| AE-100 | 92.8 | 7.0 | 0 | 0 | Li=0.2 | 1410 | 1610 | 5.46 |
| S-475 | 95 | 0 | 0 | 0 | Al=5 | 1550 | 1600 | 5.73 |
| AT-601 | 97 | 0 | 0 | 0 | Li=3 | 1115 | 1235 | 3.54 |
| AT-600 | 98 | 0 | 0 | 0 | Li=2 | 1290 | 1400 | 4.03 |

## SILVALOY & PRECIOUS METAL ALLOYS

The American Platinum & Silver Division is ready to supply your brazing needs. The alloys listed here are part of the AP&S service. Refer your brazing problems to us for our recommendations, or write to American Platinum & Silver Division directly, or to your local Silvaloy distributor.

Silvaloy compositions include all commercially important silver base alloys and many special purpose compositions. The popular low temperature Silvaloy 35, Silvaloy 45, Silvaloy 15 are included in this group. If other compositions are required they can be supplied on special request.

**We Recommend #1200 or Black Flux with Silvaloy Brazing Alloys**

**Ask for "A Complete Guide to Successful Silver Brazing...."**

## PRECIOUS METAL BRAZING ALLOYS

| ENGALOY PM | NOMINAL COMPOSITIONS | | | | | Solidus °F | Liquidus °F | Density troy oz /cu in |
|---|---|---|---|---|---|---|---|---|
| | Au | Pd | Ag | Cu | Other | | | |
| 478 | | 5 | 68 | 27 | | 1480 | 1490 | 5.31 |
| 491 | | 10 | 58 | 32 | | 1520 | 1565 | 5.30 |
| 490 | | 15 | 65 | 20 | | 1565 | 1650 | 5.45 |
| 493 | | 20 | 52 | 28 | | 1615 | 1650 | 5.41 |
| 492 | | 25 | 54 | 21 | | 1650 | 1740 | 5.51 |
| 428 | | 5 | 95 | | | 1780 | 1850 | 5.56 |
| 431 | | 10 | 90 | | | 1835 | 1950 | 5.60 |
| 447 | | 20 | 80 | | | 1960 | 2150 | 5.67 |
| 485 | | 30 | 70 | | | 2120 | 2250 | 5.74 |
| 238 | 80 | | | 20 | | 1630 | 1630 | 8.28 |
| 261 | 75 | | 5 | 20 | | 1625 | 1640 | 7.99 |
| 265 | 72 | | | | (Ni=22) (Cr=6) | 1785 | 1835 | 7.48 |
| 242 | 37.5 | | | 62.5 | | 1814 | 1859 | 5.90 |
| 260 | 35 | | | 65 | | 1832 | 1870 | 5.80 |
| 243 | 35 | | | 62 | Ni=3 | 1787 | 1886 | 5.81 |
| 255 | 82 | | | | Ni=18 | 1742 | 1742 | 8.41 |
| 129 | | 60 | | | Ni=40 | 2260 | 2260 | 5.58 |
| 440 | | 20 | 75 | | Mn=5 | 1830 | 2050 | 5.56 |
| 441 | | 33 | 64 | | Mn=3 | 2100 | 2190 | 5.70 |

Precious metal compositions provide higher brazing temperatures as may be required for vacuum tube, aircraft, or missile use. These alloys will provide good corrosion resistance and minimum diffusion into base metals. They are ideal for atmosphere brazing.

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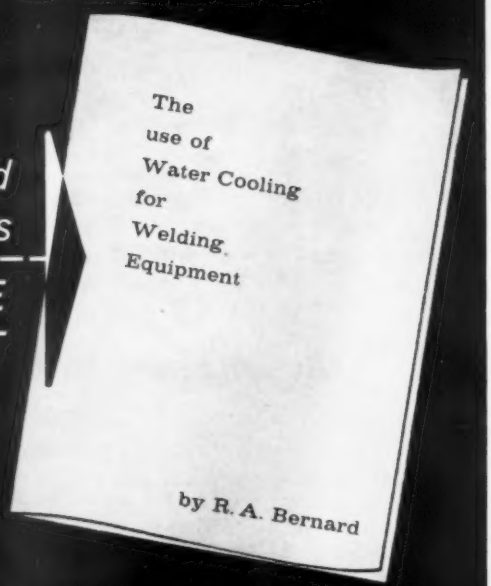


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**FOR THE FIRST TIME** since 1951, the Metal Show will be held in Detroit. Technical sessions and educational exhibits will be presented in Detroit's new Cobo Hall (foreground), October 23-27.

# Metal Show returns to Detroit after 10 years

DETROIT: Latest advances in engineering materials and materials processing will be reported in 68 half-day sessions and shown in 275 educational exhibits at the 1961 Detroit Metal Show, October 23-27, in beautiful, new Cobo Hall.

**WATCH FOR THIS SYMBOL** while you read this special Metal Show issue of WELDING DESIGN & FABRICATION Magazine.

It will lead you to a special report by the president of a machine tool manufacturing company on why his company switched from castings to weldments.

This symbol is also your guide to a series of high-interest feature articles on the welding and fabricating of aluminum, cobalt, columbium, tantalum, tungsten, and heat-resistant steels.

### TECHNICAL PAPERS

Participating with the American Society for Metals in joint sessions will be the American Welding Society (two sessions), Metal Treating Institute, American Gas Association, Industrial Heating Equipment Association, Metal Powder Industries Federation, Special Libraries Association, and Ultrasonic Manufacturers Association. Two others are the Society for Nondestructive Testing and the Metallurgical Society of AIME.

### AWS-ASM

The American Welding Society and ASM will hold a joint symposium on Thursday, October 26, with morning and afternoon sessions at Cobo Hall.

New welding processes to be discussed in the morning are electro-slag welding (W. H. Wooding of Arcos Corp.); electron beam welding (E. A. Franco-Ferreira, Oak Ridge National Laboratory); and friction welding (M. B. Hollander, American Machine & Foundry).

Gas shielded welding will be discussed in the afternoon by P. J. Rieppel, Battelle Memorial Institute; W. B. Blackburn, International Harvester Co.; and T. W. Shearer, Fisher Body Division of GMC.

### MTI-ASM

The Metal Treating Institute and ASM will present a Thursday afternoon session on how brazing can cut costs. Four speakers will discuss furnace brazing of stainless and aircraft steels. A fifth speaker, E. S. Chamer of Handy & Harman, will discuss salt bath brazing of aluminum.

### SNT

Many of the papers to be presented at meetings of the Society for Nondestructive Testing will be of interest to the welding people who attend the Metal Show. One of these will be on an X-ray image enlargement system for inspection of missile case walls and weldments. It will be presented by Robert C. McMaster of Ohio State University.

SNT will also hold a one-day conference on the inspection of steam power and nuclear power plant components. The conference is sponsored by the Society's Utilities Committee of which Helmut Thielsch, Grinnell Company, is chairman.

**ULTRASONICS**

On Thursday afternoon ASM will join with the Ultrasonic Manufacturers Association in a session that will highlight recent developments in ultrasonic cleaning, machining, joining, and inspecting.

**EDUCATIONAL THEME**

The Metal Show's educational theme will take shape in the form of a dramatic ASM Materials Application Center, a 12,000 sq. ft. exhibit area that presents seven groups of engineering materials for comparison as to more than six specific properties. Scores of sample parts, components, and test specimens will be brought together under the 30-foot-arches of the Metal Show Quadrilon.

Seven pavilions, one each for each materials group, will radiate from the Quadrilon like spokes. Visitors will be able to see what each materials group has to offer in specific properties categories, as well as compare all materials groups for specific properties to meet specific requirements. Each pavilion will be roofed with symbolic girders and will be color-coded.

Materials groups include wrought ferrous, wrought nonferrous, cast ferrous, cast nonferrous, special purpose, nonmetallic, and composite.

Properties categories are strength, high temperature, corrosion resistance (atmospheric), corrosion resistance (processing), fatigue, low temperature, and general.

## Workshop Courses for Supervisors

TROY, OHIO: Four short workshop courses for welding supervisors will again be conducted by Hobart Brothers Technical School. Here is the schedule:

October 9-13: Arc Welding Inspection and Quality Control.

November 13-17: Welding Fundamentals for Supervisors and Engineers.

November 27-December 1: Automatic Welding for Management.

December 4-8: Gas Shielded Arc Welding Processes.

Registration fee for each 5-day course is $50 per man. Text and complete reference material are furnished.

*more news on page* 12

## *These companies are exhibiting welding products . . .*

**A**

Acme Manufacturing Co.
Aerobraze Corporation
Ajax Electric Company
Allegheny Ludlum Steel Corp.
Aluminum Co. of America
Allison Campbell Division of American Chain & Cable Co., Inc.
American Chain & Cable Co., Inc.
American Machine & Foundry Co.
American Optical Co.
American Pullmax Co., Inc.
Arcweld Sales Co.

**B**

Babcock & Wilcox Co., Tubular Products Div.
Bausch & Lomb, Inc.
Beaver Pipe Tools, Inc.
Beryllium Corporation
Binks Manufacturing Co.
Branson Instruments, Inc.
The Budd Company

**C**

Cam-Lok Division, Empire Products, Inc.
Cavitron Equipment Corp.
Circo Corporation
Copperweld Steel Co.
Curtiss-Wright Corp.

**D**

Despatch Oven Company
Detroit Testing Machine Co.
Dow Chemical Co.
E. I. DuPont de Nemours & Co.

**E**

Elox Corp. of Michigan
Engelhard Industries, Inc.
Exomet, Inc.

**G**

General Electric Co.
Great Lakes Steel Corp.

**H**

Hamilton-Electrona, Inc.
Harper Electric Furnace Corp.
Hobart Brothers Co.
E. P. Houghton & Co.
Hydraulics & Pneumatics Magazine

**I**

Inductotherm Corporation
Industrial Publishing Corp.

**J**

Jones & Laughlin Steel Corp.

**K**

Kester Solder Company
King Tester Corp.

**L**

Lake Chemical Company
Lapeer Manufacturing Co.
La Salle Steel Company
Lennox Tool & Machine Builders
Lepel High Frequency Labs, Inc.
Lincoln Electric Company
Lindberg Engineering Co.
Linde Company, Division of Union Carbide Corporation

**M**

Magnaflux Corporation
Markal Company
Merit Products, Inc.
Merrill Brothers
Mine Safety Appliances Co.
Minnesota Mining & Mfg. Company
Modern Manufacturing Co., Inc.

**N**

National Carbon Company
National Steel Corp.
Nelson Stud Welding, Division of Gregory Industries, Inc.

**O**

Oakite Products, Inc.
Ohio Crankshaft Co.
Tinius Olsen Testing Machine Co.

**P**

Picker X-Ray Corporation
Power Transmission Design Magazine
Precision Metal Molding Magazine

**R**

Republic Steel Corporation
J. A. Richards Company

**S**

Selas Corp. of America
A. O. Smith Corporation
Southwestern Engineering Co.
Sperry Products Co.
Steel City Testing Machines Co.
F. J. Stokes Corporation

**T**

Tempil Corp.
Turco Products, Inc.

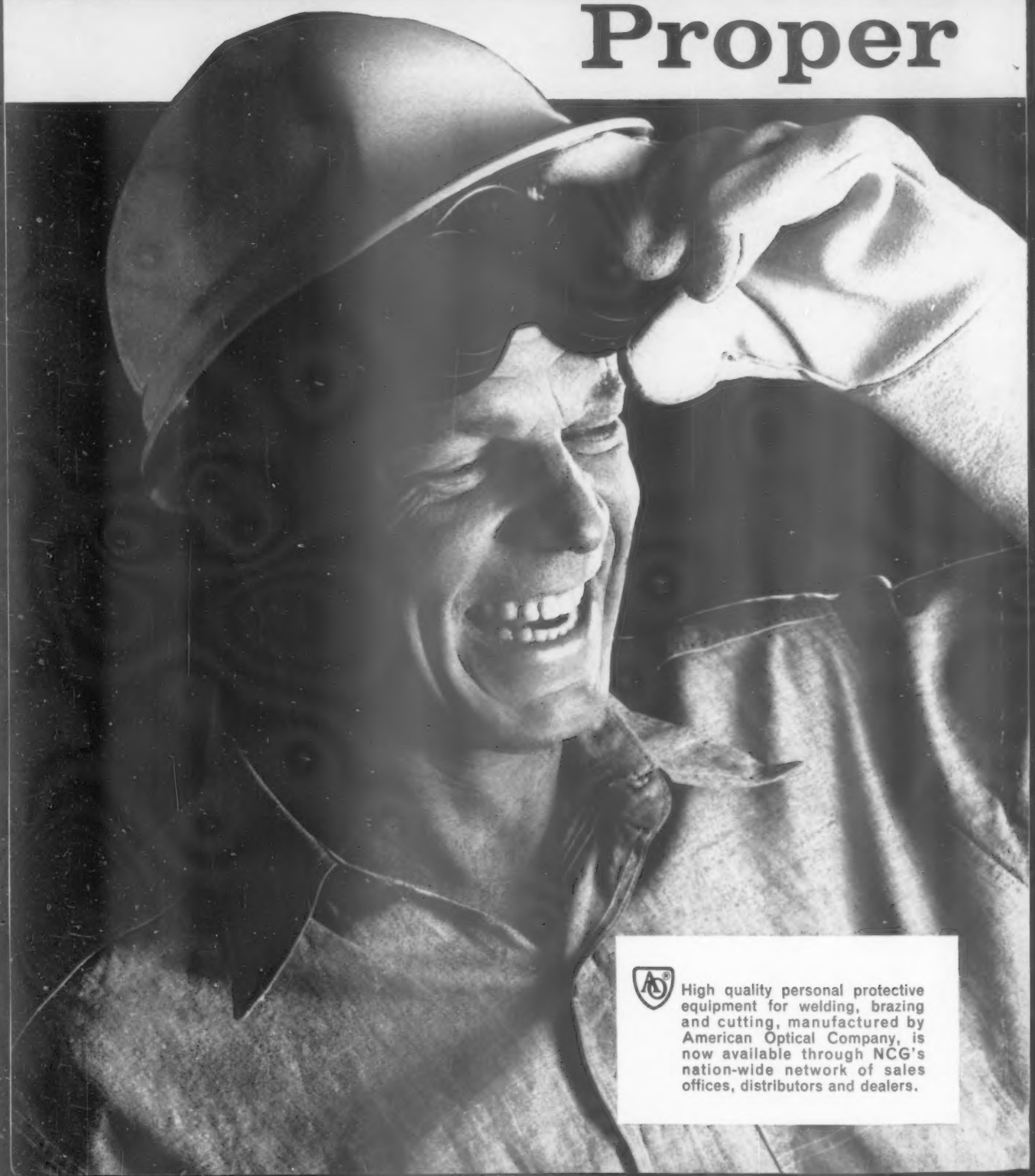
**U**

United Clamp Mfg. Co.
United States Steel Corp.

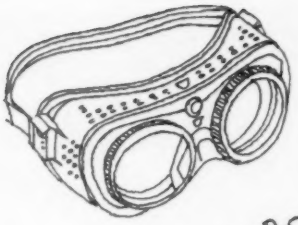
**W**

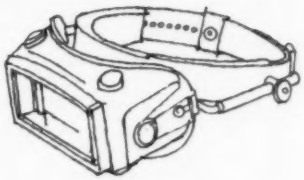
Wales Strippit, Inc.
Wall Colmonoy Corp.
Welding Design & Fabrication Magazine
Wells Manufacturing Co.
Weltronic Company
Westinghouse Electric Corp.
Wiedemann Machine Co.
Willson Mechanical Instruments, American Chain & Cable Co., Inc.

# Proper



High quality personal protective equipment for welding, brazing and cutting, manufactured by American Optical Company, is now available through NCG's nation-wide network of sales offices, distributors and dealers.





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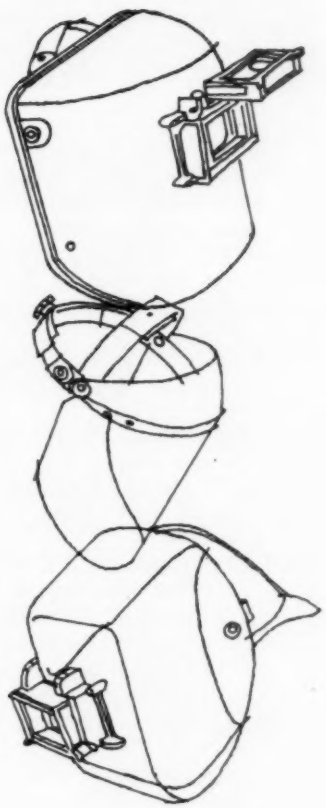

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BUCKET TOOTH SOCKETS—reinforce with Manganal Round Bars.
BUCKET CUTTING EDGES BETWEEN TEETH — cut from Manganal Hot Rolled Wedge Bars.
BUCKET FLOOR LINER — flame cut and bend from Manganal Hot Rolled Plate.
BUCKET HITCH PINS & HINGE PINS — cut from Manganal Round Bars.
CRACKED BUCKET LIP—repair with Manganal Electrodes for extra strength.
BUCKET HEEL — reinforce with Manganal Flat Bars.
BUCKET TAPERED LIP—form from various thicknesses of Manganal Round Bars.
BUCKET TEETH — repoint with Manganal Wedge Bars.

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## Marquette Purchases Canadian Company

MINNEAPOLIS: Marquette Corporation has purchased the Regent Equipment Manufacturing Co., Ltd., Rexdale (Toronto) Canada. Regent is a leading manufacturer of electric arc welders, battery chargers, testers, and motor tune-up equipment in Canada. It was founded in 1927 and built the first arc welders made in Canada.

Marquette products will be manufactured in Regent's modern plant as soon as possible.

### COMING EVENTS

**October 9-10:** N.W.S.A. West Central Zone Meeting, Raddison Hotel, Minneapolis.

**October 12-13:** N.W.S.A. Western Zone Meeting, Riviera Hotel, Las Vegas.

**October 21:** Second Annual Welding Institute for High School Teachers, University of Wisconsin, Madison, Wisconsin.

**October 23-27:** Metal Show, Cobo Hall, Detroit.

**October 23-25:** Fall Meeting of Abrasive Grain Association, Waldorf-Astoria Hotel, New York City

**November 27-28:** N.W.S.A. Southeastern Zone Meeting, Dinkler-Plaza, Atlanta.

**November 30-December 1:** N.W.S.A. Southwestern Zone Meeting, Sheraton-Dallas, Dallas.

## Air Products Acquires Delta Oxygen Company

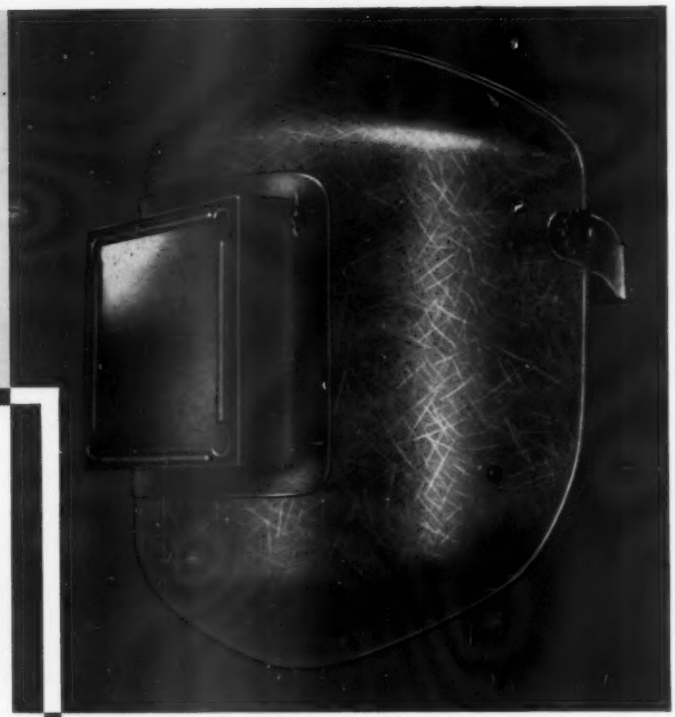
ALLENTOWN, PA.: Air Products and Chemicals, Inc., has acquired the business and assets of Delta Oxygen Co., Inc., Memphis.

Delta Oxygen manufactures and distributes oxygen, nitrogen, argon, acetylene, hydrogen, and welding and cutting equipment through facilities in Memphis, Little Rock, Paducah, Ky., and Greenwood and Clarksdale, Miss.

Air Products is a leader in the cryogenic industry. It also produces and markets industrial gases and welding and cutting equipment in the eastern and midwestern states.

*more news on page* 109

*See how CESCO has advanced welding helmet design!..*



# Detachable Neoprene Lens Retainer gives these extra advantages:

## GREATLY INCREASED VIEWING AREA • FAR LESS LENS BREAKAGE REDUCED HEAT TRANSFER • LESS WEIGHT, MORE WEARER COMFORT

*CESCO does it again!..*

From CESCO research comes a remarkable new welding helmet design with features and advantages like you've never seen in a helmet before. The **No. 401-17 helmet** shown here has a one-piece neoprene lens retainer which mounts directly to the fiber glass shell by means of moulded channels. Rubber tabs—integral parts of the retainer—hold filter, outer and inner lenses securely in place. An excellent shock absorber, the retainer greatly reduces lens breakage due to dropping or bumping the helmet. Yet when lens replacement is necessary, this can be done quickly and easily without the aid of tools.

Made to accommodate Cescoweld glass lenses or CESCO Plasti-Weld plastic filters 4½" x 5¼", the 401-17 has over twice the viewing area of regular helmets. This increased visibility, especially in the downward viewing plane, is most beneficial to wearers of bi-focal glasses. Moreover, when equipped with Plasti-Weld filters, the helmet weighs nearly one-half pound less than helmets of similar size with glass lenses and metal retainers.

Nylon headgear with broad cross strap is adjustable for height and position. Foam cushion on cross strap and brow bar provides added comfort.

***ATTENTION DISTRIBUTORS:** You're invited to inquire about CESCO's new sales and distribution policy for welding equipment distributors*

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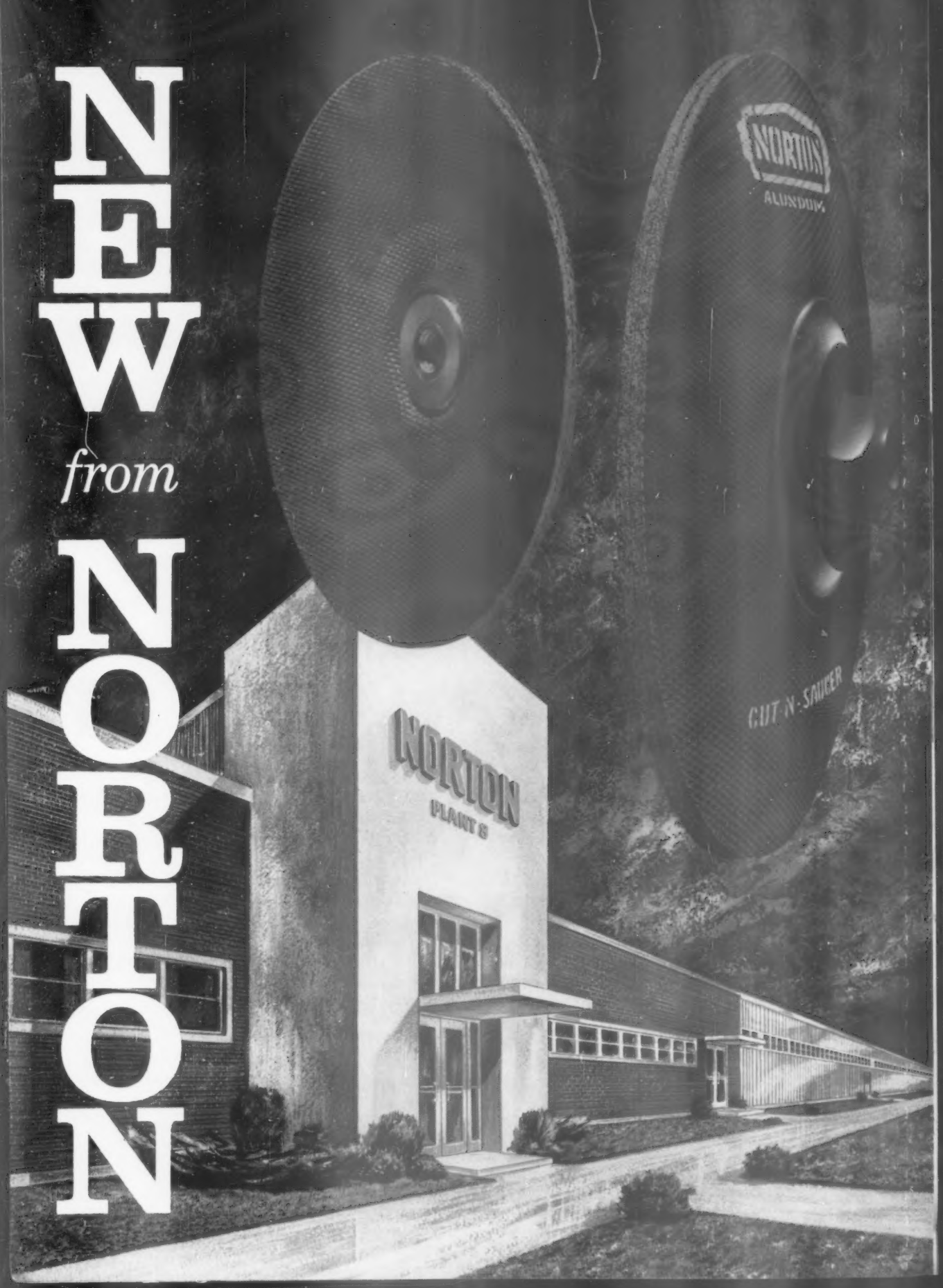
# NEW *from* NORTON



# *CUT-N-SAUCER wheels with DIS-CARD mounts*

## *A new combination from Norton's newest plant*

For easier, faster weld-grinding, light snagging and many other portable grinding jobs, Norton now offers you:

*The only reinforced wheels that combine a saucer shape with a disposable mount.*

These are the new BSA Type Cut-N-Saucer wheels with Dis-Card mounts . . . available in 7″ and 9″ diameters. They are produced in the big new Norton Plant 8, built specifically to improve the manufacture and performance of resinoid wheels.

Reinforced with layers of fibre glass, BSA Cut-N-Saucer wheels gain added advantages from the new shape. Compared with straight wheels, BSA wheels on the job can be held at angles much closer to the horizontal. Results are easier control and reduced operator fatigue.

The Dis-Card mount is equally new and vital. Unlike ordinary mounts it is no separate attachment. It is permanently secured — designed to be bought and thrown away with every wheel. This means you can change wheels in seconds — completely eliminating "lock washer" action and the usual mounting routine that can take up to half an hour. So every Cut-N-Saucer wheel you buy is already mounted — and *stays* mounted, throughout wheel life.

*Yet you pay no more for a Norton Cut-N-Saucer than for a conventional reinforced wheel!*

Cash in on this first opportunity ever offered to you to get advantages never before combined in a single, standard priced, portable grinding wheel. For further facts on the new BSA wheels — or on straight wheels also with Dis-Card mounts — see your Norton Distributor, or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

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Another ⋈ Test System at work...

*Testing rocket motor solid fuel chamber. Specially researched and developed Magnaglo unit provides multi-directional magnetization (and demagetization) to find all crack-type defects in any direction.*

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This is a specially researched and developed Magnaglo unit for testing solid propellent rocket chambers. Its 10,000 amp power pack provides multi-directional magnetization for complete detection of cracks on inside or outside surfaces of all welds, the chamber wall, exhaust ports, domes and other stressed areas. Where absolute test reliability is a million dollar responsibility, it speeds up inspection, assures complete test coverage and eliminates variations due to the human element.

You may not test rocket chambers, but a Magnaflux-built unit —special or standard—can offer you equally spectacular test safety and economies. This goes for testing virtually any component or assembly of complex shape, or awkward size.

This Magnaglo unit is just another example of Magnaflux' ability to supply a Test System or Method to meet your particular needs, however "exotic", commonplace, or for any volume. In fact, more such systems and methods come from Magnaflux than anywhere else—and have for many years. Your Magnaflux Field Engineer is ready to help you—NOW. Call him—or write Magnaflux Corporation, 7348 W. Lawrence Avenue, Chicago 31, Illinois.

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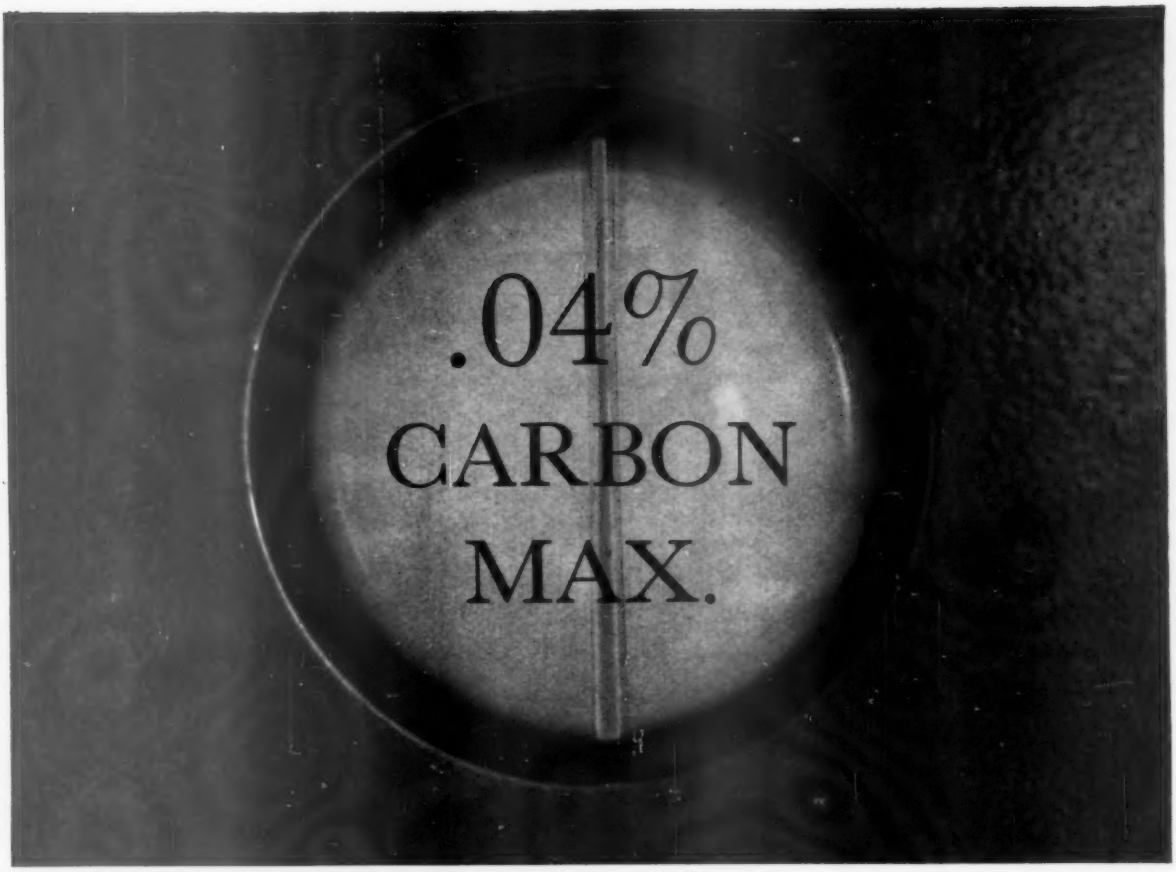

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Accurate determination of carbon content in Arcaloy stainless steel electrodes is one of the essential steps in the quality control program at Alloy Rods Company. A staff of chemists and metallurgists, using the most modern equipment and processes and following precise standards for quality, analyze weld deposits of every type and every lot of Arcaloy electrodes. The high degree of dependability long associated with Arcaloy electrodes is characteristic of all Alloy Rods' electrodes and wires . . . for stainless steel—low alloy high tensile steels—non-ferrous alloys—hard surfacing and tool steel alloys.

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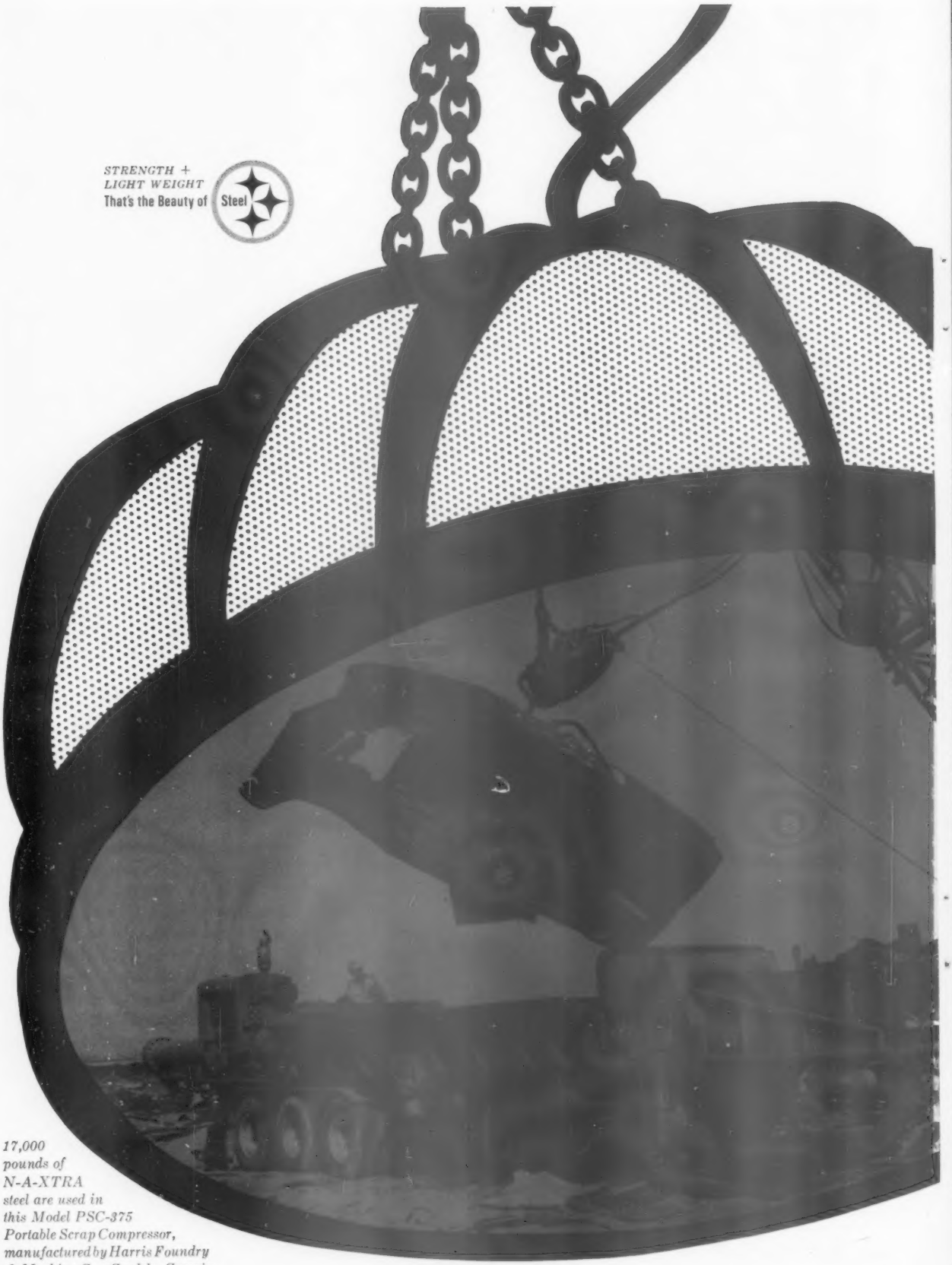
*STRENGTH + LIGHT WEIGHT*
That's the Beauty of Steel

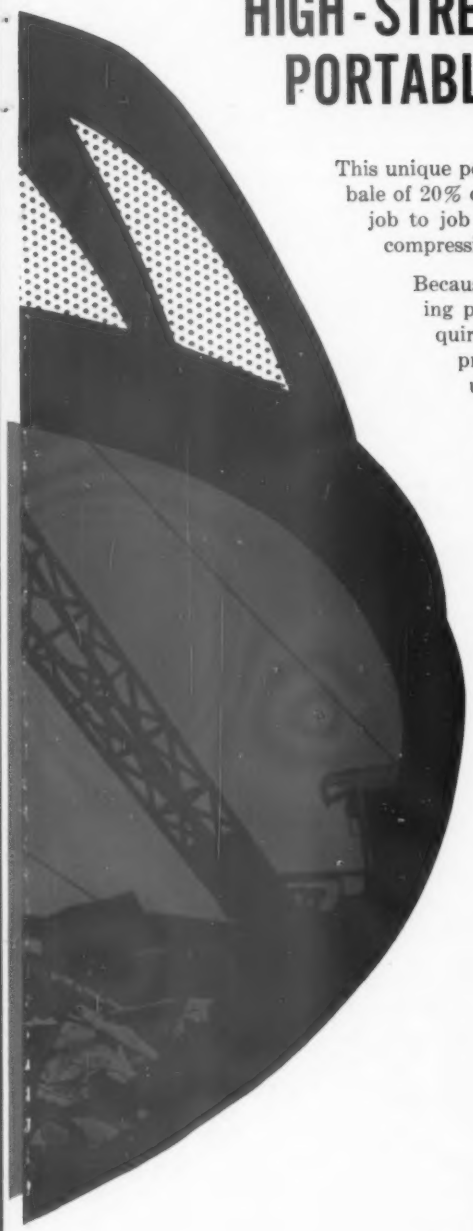


*17,000 pounds of N-A-XTRA steel are used in this Model PSC-375 Portable Scrap Compressor, manufactured by Harris Foundry & Machine Co., Cordele, Georgia*

# STRENGTH + LIGHT WEIGHT OF

# N-A-XTRA

## HIGH-STRENGTH STEEL SOLVES PORTABLE SCRAP COMPRESSOR PROBLEM



This unique portable scrap compressor can squeeze an entire auto body into a 21″ x 36″ x 24″ bale of 20% dense steel scrap, using a ram pressure of 375 tons. Designed to be hauled from job to job by a conventional truck-tractor, it goes to work in outlying wrecking yards, compressing bulky scrap into marketable bales that can be shipped economically.

Because it must be moved over the highway and meet established load limits, a pressing problem in designing the PSC-375 was weight. Mild carbon steel with the required strength would weigh too much. N-A-XTRA high-strength steel solved the problem. It fully met all strength and fabrication requirements, yet kept total unit weight within acceptable limits for portability.

Portability may not be the controlling factor in your product—but the same steel that solved this problem is the one to remember when only the strongest steel will do. Pound for pound, N-A-XTRA steels are nearly three times stronger than mild carbon steel. Rugged conditions, heavy loads and weight-saving construction—in such applications, for example, as heavy machinery and pressure vessels—are challenges that N-A-XTRA is designed to meet.

With excellent weldability, formability, and toughness even at subnormal temperatures, N-A-XTRA low carbon, extra strength alloy steels give superior results with conventional fabricating methods, including cold forming, gas cutting, shearing and machining. N-A-XTRA high-strength steels are available in four levels of minimum yield strength, from 80,000 to 110,000 psi, and in sizes ranging from ⅛″ to 1″ thick, up to 72″ wide and up to 35′ long. For further information, write Product Development, Dept. WDF-12, Great Lakes Steel Corp., Detroit 29, Michigan.

*DESIGN NOTE: Model PSC-375, Portable Scrap Compressor, uses N-A-XTRA 100 (minimum yield strength, 100,000 psi) in engine and tank mounts, bed and side ribbing, arm housings and end housing. Sizes—¼″, ⅜″, ½″, ¾″ and 1″ thick. Fabrication followed standard gas cutting and welding procedures.*

N-A-XTRA
HIGH-STRENGTH STEELS

a product of

## GREAT LAKES STEEL

Detroit 29, Michigan

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| Interstate Steel Co.<br>Des Plaines, Illinois | Lockhart Iron & Steel Co.<br>Pittsburgh, Pennsylvania | Marsh Steel & Aluminum Co.<br>Kansas City, Missouri |
| O'Neal Steel, Inc.<br>Birmingham, Alabama | Salt Lake Hardware Co.<br>Salt Lake City, Utah | A. C. Leslie & Company, Ltd.<br>Montreal, Canada |

***Great Lakes Steel is a Division of*** **NATIONAL STEEL CORPORATION**

**For More Information Circle No. 47 on Reader Service Card.**

# EVERYONE...

## is headed for the 1961 DETROIT METAL SHOW

**THE WORLD'S MOST COMPREHENSIVE METALS AND PROCESSING EVENT**

**OCTOBER 23RD THROUGH 27TH • COBO HALL**

Ideas . . . Ideas . . . Ideas . . . stimulating, thought-provoking ideas. How to improve production . . . how to cut costs . . . how to stay ahead of competition. SEE – hundreds of educational exhibits. HEAR – presentation of over 200 technical papers. EXAMINE – processing, inspection and control equipment. VISIT – the spectacular Materials Comparison Center. Yes, *everyone* . . . especially the IDEA man for his company . . . is headed for the 1961 Detroit Metal Show. He wants to *KNOW* more . . . DO YOU?

PLAN NOW TO ATTEND THIS GREAT SHOW!

ORGANIZE A COMPANY GROUP FOR TRAVEL AND ACCOMMODATION ECONOMY!

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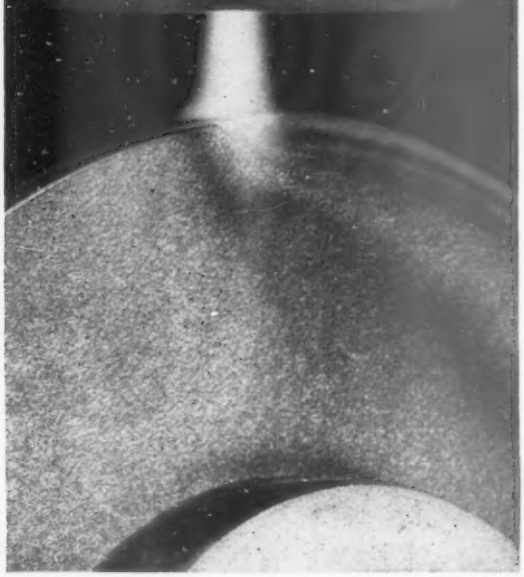
LINDE ELECTRIC WELDING



# PLASMARC

## NEW...HIGH-SPEED FUSION OF VERY-THIN DEPOSITS WITH CONTROLLED DILUTION

From LINDE, the inventor of plasma arc processes, comes PLASMARC weld surfacing – the first process for depositing very-thin fused overlays of heat-, wear- and corrosion-resistant materials, with controlled dilution, at high speeds. PLASMARC weld surfacing utilizes the intense heat (30,000° F.) of a constricted plasma arc created within its torch and transferred to the work. The metal is fed into the torch as a powder. It is carried to the work in the plasma jet formed from argon gas. *Check these features:*

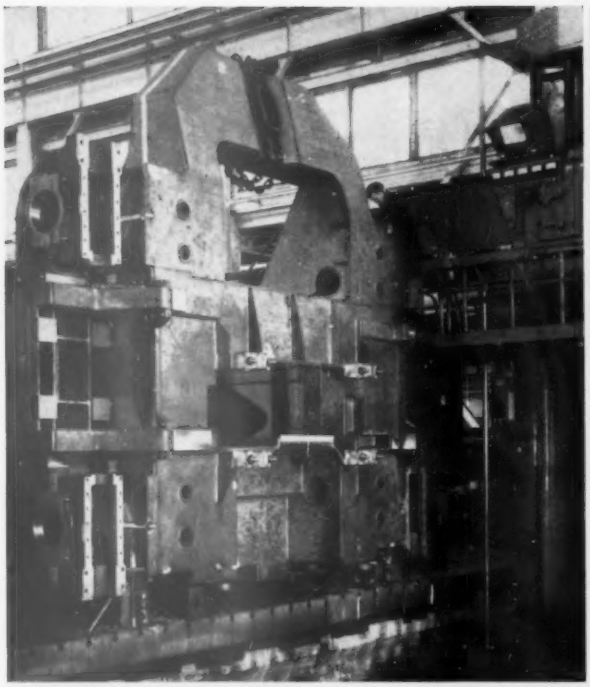
- Penetration into base precisely controlled to .005-in. and up.
- Dilution with base precisely controlled to 5% up to 50%.
- Deposits as thin as .010-in., as thick as 3/16-in., in one pass.
- Deposits as narrow as 1/8-in., as wide as 1 in. or more.
- Speeds over 20 ipm at 95% deposition efficiency.
- Flatter, smoother deposits than other fusion processes.
- Wide choice of metal and alloy powders for surfacing.

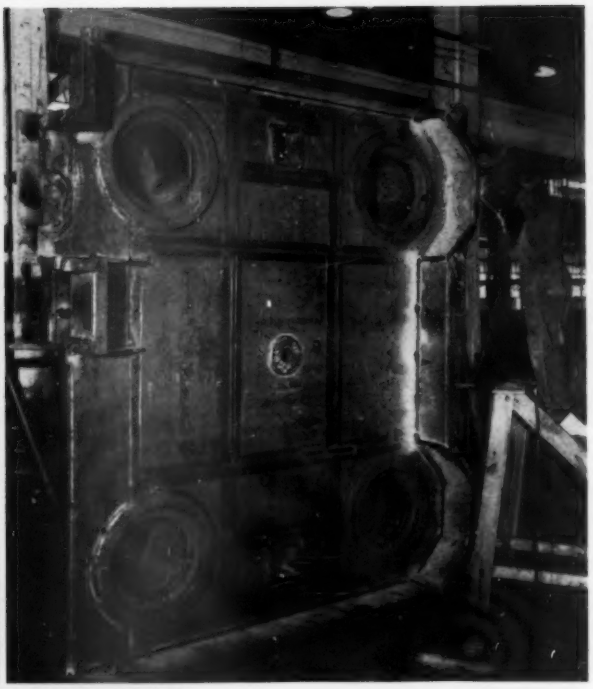
SEE IT "LIVE" AT THE METAL SHOW
Cobo Hall, Detroit, Booth 127, October 23-27

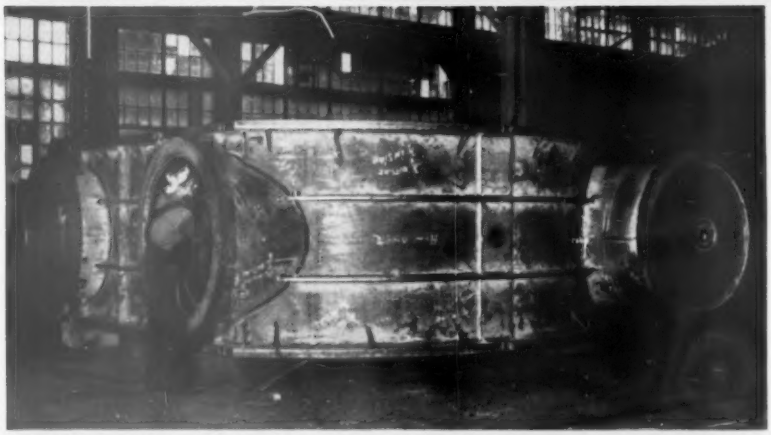
**LINDE COMPANY**
Division of Union Carbide Corporation
270 Park Avenue, New York 17, New York

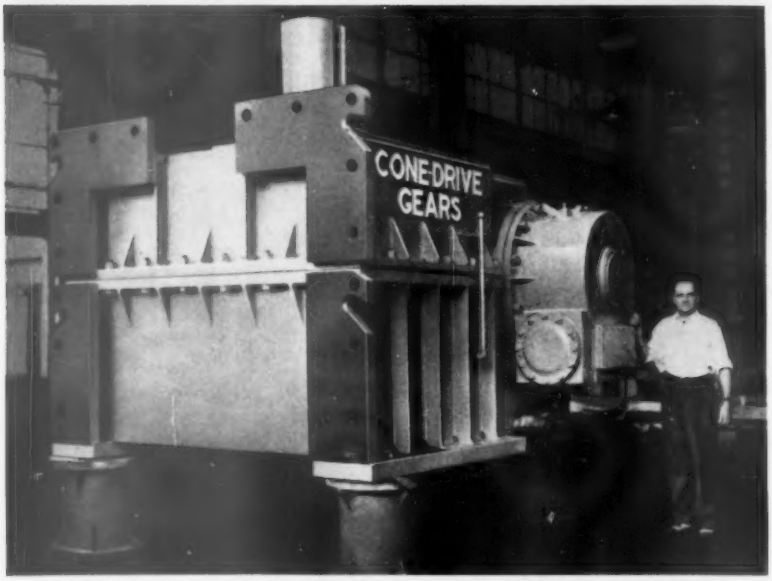
UNION CARBIDE

**For More Information Circle No. 69 on Reader Service Card.**










# How Morgan weldments can solve problems for you!

The nationally known facilities, experience and craftsmanship of The Morgan Engineering Company are available to produce components for your products. Whether you need small weldments in quantity, or large parts like these, you can subcontract this part of your production profitably and confidently.

Inspection of our plant is welcomed. Write, wire or phone for complete information—or ask a Morgan sales engineer to call.

E.O.C.I. MEMBER

THE
**MORGAN**
**ENGINEERING CO.** *Alliance, Ohio*

Overhead electric traveling cranes, gantry cranes, open hearth special cranes, plate mills, blooming mills, structural mills, shears, saws and auxiliary equipment.

**For More Information Circle No. 82 on Reader Service Card.**

# N.A.S.A. Puts its Thrust in STEEL FABRICATORS' Weldment

How does a rocket behave when landing on a planet? No one knows for sure, but at the N.A.S.A. Lewis Research Center in Cleveland, they are finding out.

As part of the research program, they needed a thrust stand to support the simulated rocket. Here's where Steel Fabricators Company's welding skills and facilities came into the picture.

To build a unit composed of steel plate, channel, and pipe, aluminum plate, angle and floor plate and heavy copper tubing, to tolerances within 1/10 of an inch, requires a hard-to-find range of welding experience and special equipment.

Yet Steel Fabricators Company successfully bid for this big weldment—the top plate is 17 feet square, 1-1/2" thick; the shell is 12' in diameter, 1-1/8" thick; the overall height is 7'; the shipping weight was about 30,000 pounds—and delivered it on time, in one piece, ready for installation at the propulsion laboratory.

*To find out more about our facilities and skills, write for a FREE descriptive brochure.*

Thick steel parts were joined by automatic submerged arc-welding — X-ray quality.

Aluminum undercarriage of cover plate was welded by inert gas, consumable electrode method.

Heavy, formed copper tubing was brazed to steel flanges. Note supports for removable tracks of cover plate.

**THE STEEL FABRICATORS COMPANY**

**1260 CENTER STREET CLEVELAND 13, OHIO**

**For More Information Circle No. 96 on Reader Service Card.**


# MEN ON THE MOVE

*in the welding industry*

## APPOINTMENTS:

BICHSEL

CHANEY

**Harry J. Bichsel** has been named manager of the Westing-Arc Department of the Westinghouse Electric Corp. He replaces **Richard C. Lipps** who has resigned.

**Jack Chaney** has joined the sales staff of Fibre-Metal Southeast, Inc. of Decatur, Ga.

The Harris Calorific Co., Cleveland, has appointed three men to its engineering staff: **Frank Hach, Jr.,** chief industrial engineer; **Alfred E. Burnell** and **Joseph J. Okladek,** product engineers.

**Ralph L. Tomlinson, Jr.** has been appointed sales representative in the greater Los Angeles area for Alloy Rods Co., York, Pa.

**Roger W. Williams** has been appointed to the sales engineering staff of the Chicago Eye Shield Co., Chicago.

**Thomas J. Whitby** has been appointed information scientist—metallurgical in the New Haven research service department, Olin Mathieson Chemical Corp.

**Richard C. Kanak** has been appointed territory manager for Smith Welding Equipment Div., Tescom Corp. in the Chicago-Milwaukee area.

**George R. McClaud** has been appointed service, training, and distribution center manager for the Eutectic Welding Alloys Corporation's Pacific Division, Bay Area Branch, Oakland.

*continued on page 24*

# A. O. Smith electrodes are strictly top shelf

When you reach for an A. O. Smith electrode, you've reached a high point in quality. We're not stretching that point when we say that our electrodes are backed by the industry's strictest quality control program. We test 'em by eye! We test 'em mechanically! We test 'em electronically! We weld test 'em after baking. We do everything humanly possible to assure top performance welds.

We think we know a good thing when we weld with it. You will too when you reach for an electrode made by A. O. Smith.

*Through research* A.O. Smith *... a better way*

**A.O.Smith**
CORPORATION

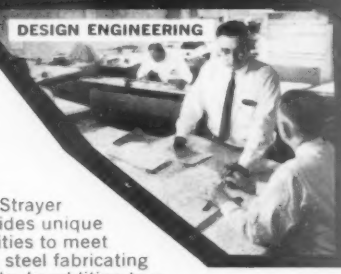
**WELDING PRODUCTS DIVISION**
Milwaukee 1, Wisconsin
A. O. Smith INTERNATIONAL S. A.
Milwaukee 1, Wisconsin, U. S. A.

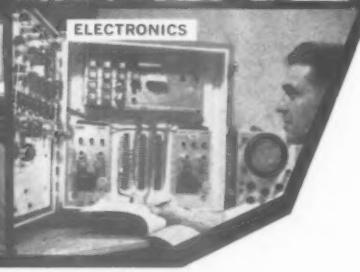
**For More Information Circle No. 94 on Reader Service Card.**

ERIE STRAYER

NEW SOURCE for Steel Fabricating

A Unique Combination of Facilities For Both Design And Manufacture




Erie Strayer provides unique facilities to meet your steel fabricating needs. In addition to a modern, fully equipped plant for the fabrication and welding of plate and structural components Erie Strayer also offers . . . a staff of licensed design engineers qualified for mechanical and structural design . . . a fully equipped electronic laboratory for development and manufacture of electronic systems . . . a fully equipped machine shop.

Over 100,000 square feet of covered floor space (40 foot overhead clearance) is serviced by 25 ton overhead cranes. The plant has its own railroad siding, and is served by numerous common truck carriers (Company owned trucks serve close-by areas) and the Seaway is conveniently near.

A favorable labor market puts a trained work force at your disposal at highly competitive costs.

We welcome the opportunity to quote on your requirements.

*Write For Useful Facilities Booklet!*

ERIE STRAYER

SPECIAL PRODUCTS DIVISION
Rudolph Road and NKP Railroad
Erie, Pennsylvania

**For More Information Circle No. 41 on Reader Service Card.**


## MEN ON THE MOVE

*continued from page 22*

### APPOINTMENTS:

**LeRoy Wymss** has been appointed comptroller for All-State Welding Alloys Co., Inc., White Plains, N. Y.

**Cecil Miles** has been appointed Southeastern factory sales representative for Sellstrom Manufacturing Co., Palatine, Ill.

**Jack R. Saddler** has been appointed manager-sales, South Atlantic district, J. B. Nottingham & Co., Inc.

**T. T. (Ted) Diehl** has been appointed sales engineer specializing in electrodes, automatic wire, and fluxes by the Weber Welding Supply Co., Pittsburgh.

### PROMOTIONS:

CLARKE

BRONCO

**K. C. Clarke** has been named vice president of Shawinigan Products Corp., N. Y.

**T. P. Bronco** has been appointed sales manager for the New York district of Page Steel and Wire Division of American Chain & Cable Co., Inc. **Ernest S. Wallhofer** has been appointed manager of their Monessen, Pa. plant.

**Michel R. Parrett** has been appointed a grinding wheel sales representative by Norton Company, Worcester, Mass. to cover the Iowa area.

**G. L. Werly Jr.** has been appointed general marketing manager of Air Reduction Sales Co. **R. H. Merriman** will succeed Mr. Werly as manager of Airco's gas marketing department.

*continued on page 26*

***For the man on the job...***

# THE VICTOR JOURNEYMAN UNIT

**The most flexible, useful tools in the metalworking industry**

For cutting, welding, melting, brazing, hardfacing, heating, heat treating, heat priming and descaling, The Journeyman Unit provides a complete outfit of VICTOR quality, standard industrial-type equipment, including:

Regulators . . . SR400 series single stage safety type
Welding Torch . . . Model 315 (9" long)
Cutting Attachment . . . Model CA2050
Welding Nozzles . . . Type 4, sizes 1, 3, 5*
Cutting Tip . . . Type 3-101, size 1* (cuts to 1")
Accessories . . . 25 ft. ¼" dual hose, goggles, spark lighter, wrench and instruction book (Form 1)

*Additional types and sizes can be added as needed to extend the work range of the unit.

**Available at all VICTOR dealers in the U. S. A. for $175.95 Order NOW**

85

VICTOR
for welding
and cutting

**VICTOR EQUIPMENT COMPANY**

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3821 Santa Fe Avenue, Los Angeles 58 • 1145 E. 76th St., Chicago 19

Manufacturers of welding and cutting equipment; high pressure and large volume gas regulators; hardfacing rods; blasting nozzles; cobalt and tungsten castings; straight-line and shape cutting machines; roller and idler rebuilding machines.

**For More Information Circle No. 105 on Reader Service Card.**

Your king-size weldment problems can be solved with Lewis king-size facilities and experience. We specialize in weldments from 1 to 35 tons and Lewis integrated facilities offer you complete design, welding and machining service for even the largest weldments.

**DESIGN**

Our engineering department includes weldment specialists experienced in machine design and cost-saving casting conversion. Lewis engineers will consult with your engineers from blueprint to fabrication of large custom weldments.

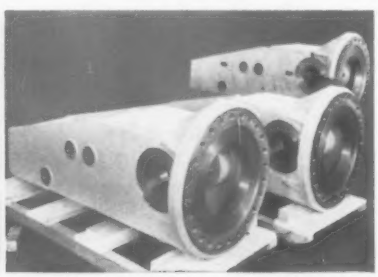
**MATERIALS**

Lewis is equipped to process both carbon and alloy steels and the usual commercially applicable non ferrous materials including monel, inconel and aluminum.

**MACHINING**

The wide variety of heavy duty machine tools of the Lewis Machine Division are available to you for the precise finishing of large welded structures and components.

Large flywheel fabrication



Precisely machined steel weldments

LEWIS

Please send me your booklet describing Lewis facilities. I am particularly interested in:
Design ☐ Weldments ☐ Fabrication ☐
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THE LEWIS WELDING & ENGINEERING CO.
Interstate and Cross Road • Bedford, Ohio

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Title_____
Company_____
Address_____
City_____ Zone_____ State_____

**For More Information Circle No. 64 on Reader Service Card.**

## MEN ON THE MOVE

*continued from page 24*

### PROMOTIONS:

**Gordon C. Campbell** has been promoted to chief industrial engineer, Alan Wood Steel Co., Conshohocken, Pa.

**Matt L. Stano** has been promoted to district manager for Southeastern Wisconsin for Eutectic Welding Alloys Corp., Flushing, N. Y.

**Stanley V. Schumann** will head the sales promotion department at American Brazing Alloys Corp., Pelham, N. Y.

### ELECTIONS:

**Miles N. Clair,** president, Thompson & Lichtner Co., Inc. Brookline, Mass., was elected president of ASTM for a one-year term.

### HONORS:

Ohio State University has selected **James W. Bradley** of Columbus and **James H. Frazier** of Cincinnati as recipients of the National Cylinder Gas Scholarships in welding engineering for 1961-62. This is Bradley's second award.

### DEATHS:

**A. J. Fisher Jr.,** executive vice president, Metal & Thermit Corp., died August 11, at Norwalk, Conn. He was 47.

### OVERSEAS:

**Peter C. Hobart,** international development consultant for Hobart Bros. Co., is attending a number of European trade fairs, including the welding and cutting exhibition at Essen, Germany. Hobart Bros. will exhibit at this show which has been opened to exhibitors from throughout the world. Mr. Hobart will also contact Hobart distributors during his extensive trip.

*A strong rubber strap adjusts at either side of the AO 488 Weld-View Goggle.*

*For cool, comfortable, wide-angle vision, try*

# New Weld-View Goggles

Here's wider vision and comfort in a new welding goggle from AO. A standard 2″ x 4¼″ welding plate is mounted in a light, comfortable, flexible vinyl mask, molded of opaque green vinylite, with a wide flange around the entire contacting edge to conform to facial contours and shut out stray light. Recessed temple slots will fit over and around all regular or safety glasses, eliminate annoying pressure. Louvres give ample indirect ventilation.

A nylon plate holder permits easy change of filter plate and cover plate, gives wearer wide-angle vision and a full view of his work. It slides easily into grooves molded in the mask, is held firmly in position without light leaks by two locking lugs.

For complete details on this new AO 488 Weld-View Goggle, or on any item in our complete welding line, contact your nearest AO Safety Products Representative, or write direct.

*Your Surest Protection* . . . AO SURE-GUARD Goggles

American Optical
COMPANY

SAFETY PRODUCTS DIVISION • SOUTHBRIDGE, MASSACHUSETTS

**For More Information Circle No. 15 on Reader Service Card.**

# WELDING MANAGEMENT

*watches these developments*

**THE 1961-62 RECIPIENT** of WELDING DESIGN & FABRICATION's Scholarship in Welding Engineering is Russell Warren Flax, Jr., (above, left) a junior at Ohio State University. Flax completed two years of pre-engineering and has been admitted to the College of Engineering's Department of Welding Engineering. He comes from Jamestown, Ohio, near Springfield.

Professor Roy B. McCauley, chairman of the Department of Welding Engineering (center), and William H. Hill, teaching assistant (right), explain a welded restraint test to Mr. Flax.

**TRAINING MEN FOR MANAGERIAL POSITIONS** in wholesale organizations is the aim of a two year program sponsored by the National Association of Wholesalers in cooperation with Ohio State University. During the 24 month period of this program, the men enrolled will attend specialized classes at Ohio State and will work for sponsoring wholesalers in alternating two month periods.

Among the first men to enroll in the course are Gerald Fry and Michael McManus of O.K.I. Supply Co., Cincinnati, wholesale distributors of welding and safety equipment and supplies.

**AN INDIAN WELDING STUDY TEAM** spent six weeks studying welding techniques used in this country. The group was made up of seven Indian industrial executives, technicians, and government officials. The 7-man team covered these phases of welding: Welding processes, equipment, and techniques; applications; training; and research. They visited these companies:

*Welding users*: North American Aviation, Inc.; McDonough Steel Co.; Kaiser Steel Co.; Ford Company; Pullman Standard Car Mfg. Co.; Chicago Bridge & Iron Co.; International Harvester Co.; Allis Chalmers Mfg. Co.; Firestone Steel Products Co.; General Electric Co.; Todd Shipyards; Fenestra, Inc.; Lukens Steel Co.

*Welding equipment manufacturers*: Air Reduction Co., Inc.; Eutectic Welding Alloys Co., Inc.; Harnischfeger Corp.; Linde Company, Division of Union Carbide Corp.; Lincoln Electric Co.; Pressed Steel Tank Co.; Sciaky Bros., Inc.; A. O. Smith Corp.; Yoder Company.

*Welding schools*: Cleveland School of Welding.

**"THE MEMBERS OF THE STEEL PLATE FABRI**cators Association are anxious to obtain sufficient foreign business to assist in maintaining an efficient shop operation and to provide work for its shop and field crews." That's the gist of a statement made recently by J. Dwight Evans, executive director, Steel Plate Fabricators Association. He made the statement before a Subcommittee on the Impact of Imports and Exports on American Employment. Mr. Evans explained why American fabricators were not getting their share of foreign contracts and suggested remedies.

**"HOW TO WELD T-1 STEEL"** is the title of a new 16 mm color-and-sound motion picture. The 18-minute motion picture shows how to get sound welds in T-1. Arrangements for group showings can be made by writing to United States Steel Corp., Room 6363, 525 William Penn Place, Pittsburgh 30, Penna.

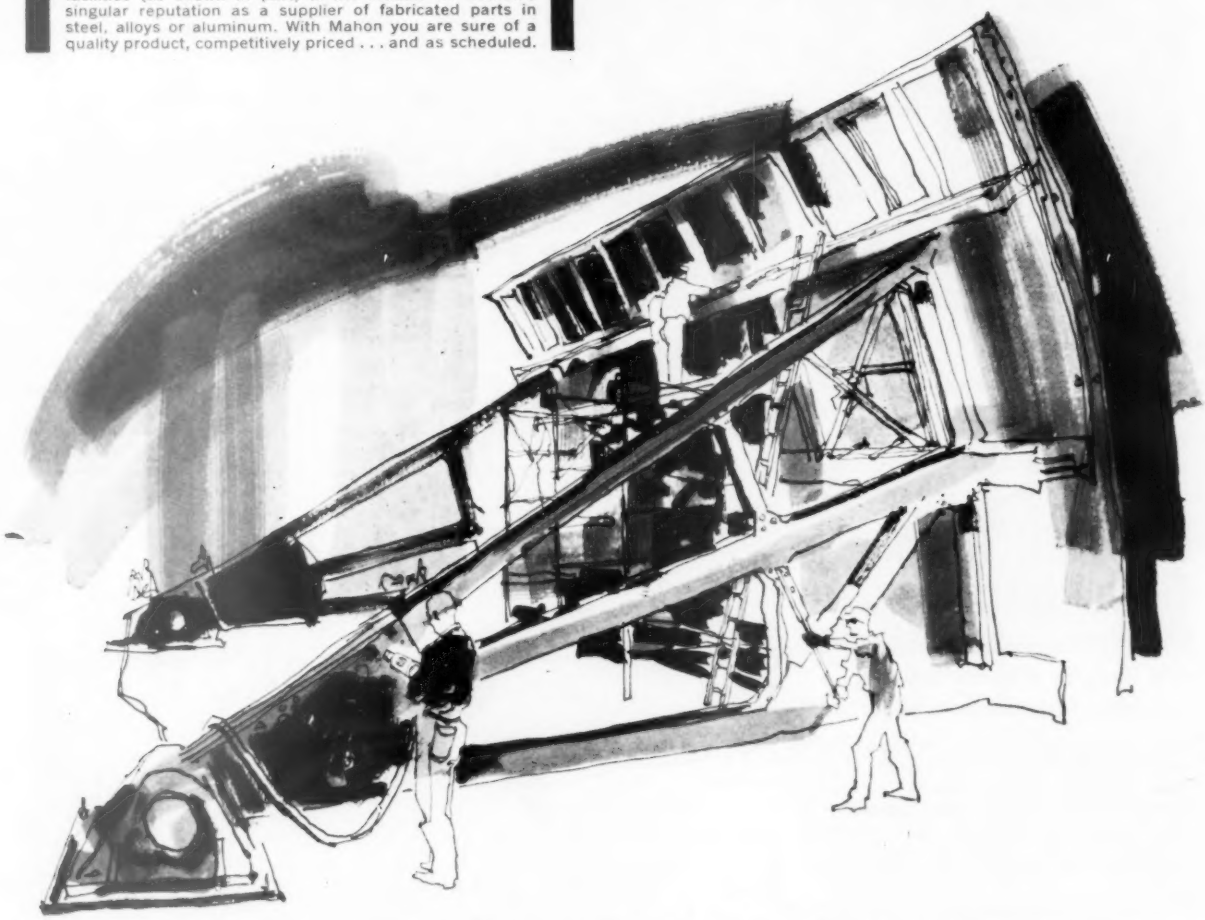
**THE SHARPEST UPSWING** in original equipment sales in 18 months was reported recently by Simon Fisher, president of National Electric Welding Machines Co., Bay City, Mich. He said orders totaling $1½ million received during June and July were the highest since February-March, 1960. Fisher, who is also president of the Resistance Welder Manufacturers' Association, said June sales reported by RWMA members climbed 65 percent over May. Fisher said 60 percent of the June-July orders his company received were from the automotive industry.

**A NEW ALLOY** for the power industry has been developed by International Nickel Company's Research Laboratory. Alloy IN-102 has nickel-chromium base and is matrix-strengthened with several percent each of columbium, molybdenum, and tungsten. It is designed for long-time service at temperatures of 1200°F. Its rupture strength at that temperature is 2 to 2½ times higher than materials currently used in such application. The alloy has excellent structural stability, retaining high ductility after long exposure to temperature and stress. Because it is essentially cobalt-free, IN-102 may find use in nuclear power applications.

Old-time craftsmanship backed by extensive modern facilities (as shown in part) is the reason for Mahon's singular reputation as a supplier of fabricated parts in steel, alloys or aluminum. With Mahon you are sure of a quality product, competitively priced . . . and as scheduled.

MEN WHO KNOW FACILITIES, CAPACITY AND **QUALITY**— INSIST ON . . .

# "fabrication by Mahon"



When quality and precision comes first—as with this 25 x 35-ft. heavy steel Tainter Gate for a flood-control dam at Waterbury, Vermont—the source should be Mahon . . . where fabrication is an art. Whether your work is mechanical or structural . . . a one-time design or a production run involving welding, machining or assembling . . . Mahon's Steel-Weld Division provides an unbeatable *single-source-service.* And the wealth of Mahon experience is yours to tap at no extra cost. Let us prove why . . . you too . . . should specify "fabrication by Mahon."

THE R. C. MAHON COMPANY • DETROIT 34, MICHIGAN

*Manufacturing Plants—Detroit, Michigan and Torrance, California*

WRITE TODAY FOR STEEL-WELD LITERATURE . . . OR FOR ON-THE-SPOT HELP DISCUSS YOUR PROBLEM WITH A MAHON FABRICATION ENGINEER.

# MAHON

**For More Information Circle No. 72 on Reader Service Card.**

FOR WELDING ELECTRODES— all you need —fast! locally!

Let your Airco Distributor know

What type of electrodes you need— mild steel, low alloy, low hydrogen, iron powder, stainless, hardfacing,

Your Airco Distributor offers electrodes for over 100 different types of work. Ask him—he'll recommend exactly the one you need to do the job right. Resealable "Pop" cans for stainless and "Barrier Cartons" for low hydrogens. Only your Airco Distributor gives electrode service like this.

Choose from **AIRCO** quality electrodes, arc welding equipment and arc welders, gas welding and cutting equipment—gas-shielded arc welding process equipment — flame cutting machines — high purity industrial gases.

Call your nearby Airco Distributor. He's listed in your Classified Telephone Directory under "Welding Equipment and Supplies."

**AIR REDUCTION**

...represented by over 700 Authorized Airco Distributors from Coast to Coast

AUTHORIZED AIRCO DISTRIBUTOR

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# LIBRARY

*of welding*

## Crack Arrestors

*"Behavior of Riveted and Welded Crack Arrestors" by R. J. Mosborg, University of Illinois, for Bureau of Ships, Department of the Navy. August, 1960. 114 pages. Order PB 171 576 from OTS, U. S. Department of Commerce, Washington 25, D. C., $2.75.*

Steel plates 2-feet-wide and 6-feet-wide containing welded inserts of T-1 steel, riveted doubler plates, or welded inserts of ABS Class C normalized steel were subjected to laboratory-propogated notch crack tests. Most of the tests were conducted at stresses between 20 and 30 ksi and at temperatures between —25 and 40°F.

A riveted doubler plate performed well; rivet holes did not necessarily attract propogating cracks. Drop-weight and explosion-bulge test results plus data from various Charpy -notch criteria are compared with the results from large scale tests of crack-arrestor specimens.

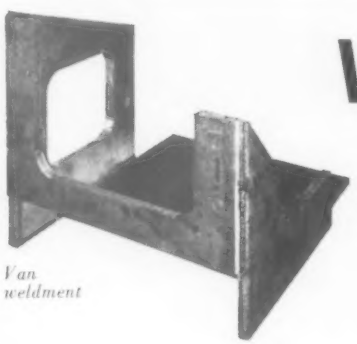
## High Temperature Brazing

*"Brazing for High Temperature Service" by H. E. Pattee and R. M. Evans, Defense Metals Information Center, for Battelle Memorial Institute, February, 1961. 32 pages. Order PB 151 108 from OTS, U. S. Department of Commerce, Washington 25, D. C., $1.00.*

New techniques in brazing heat-resistant metals and alloys for use in service temperatures over 600°F and other departures in brazing developed over the last decade by the aircraft and missile industries have been compiled in a summary document with a reference section.

The current demand for oxidation- and corrosion-resistant assemblies has complicated brazing processes. Studies in the field have investigated reactions between base metals and filler metals as well as the formation of intermetallics and the penetration of the base metal by the filler metal. Other studies noted in this summary gathered data on wettability between various high temperature base metals and filler metals in protective atmospheres of hydrogen and helium, and

*continued on page 32*



*Van weldment*

Van can make it better!

There are three factors determining whether you do your own welding or buy Van weldments . . . direct costs, indirect costs and non-cost factors such as improvement in technology. • The best way to find out whether to make or buy is to send us your blueprint today whether the part is now casting, fabricated steel or weldment. As we pioneered in stainless steel fabrication and are experts in welding, we can be neutral. If welding is indicated, we may be able to redesign. We may be able to save money several ways: part cost, shipping cost, machining economy. Write today to THE JOHN VAN RANGE CO., 445 Culvert Street, Cincinnati 2, Ohio. Savings are vital now!

VAN

WELDMENTS & FABRICATION

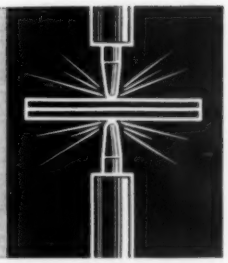
For More Information Circle No. 103 on Reader Service Card.

P R MALLORY & CO Inc

# MALLORY MEMOS

**NEWS AND TIPS ON RESISTANCE WELDING**

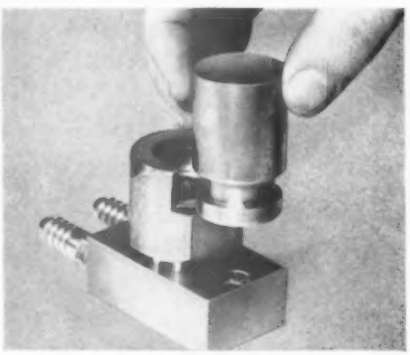
**Mallory Metallurgical Company, Indianapolis 6, Indiana**



## Welding Hints

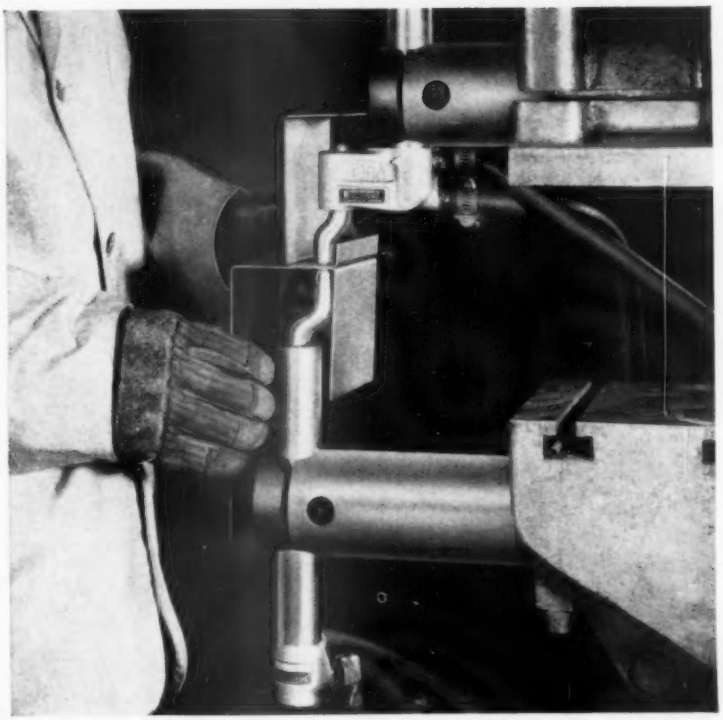
### Low Inertia Holders for Welding Soft Metals

When resistance welding yellow brass, aluminum or other metals or alloys that melt abruptly and cause "burning", Mallory low inertia holders give quick spring-loaded follow-up of pressure that assures consistently good welds. Apply them to big welding machines to convert to low-pressure welding. Interchangeable springs give you wide range of welding pressures.



### Nu-Twist® System Permits fast changing of electrodes

Turn a hex nut, slip out the old electrode, insert the new one, tighten the nut and you're ready to resume welding. Change-over time is only a few seconds, with the "Nu-Twist" combination of engineered electrodes, holders and adapters. Get a copy of our bulletin from your Mallory distributor.



## Another "special" set-up solved with standard Mallory components

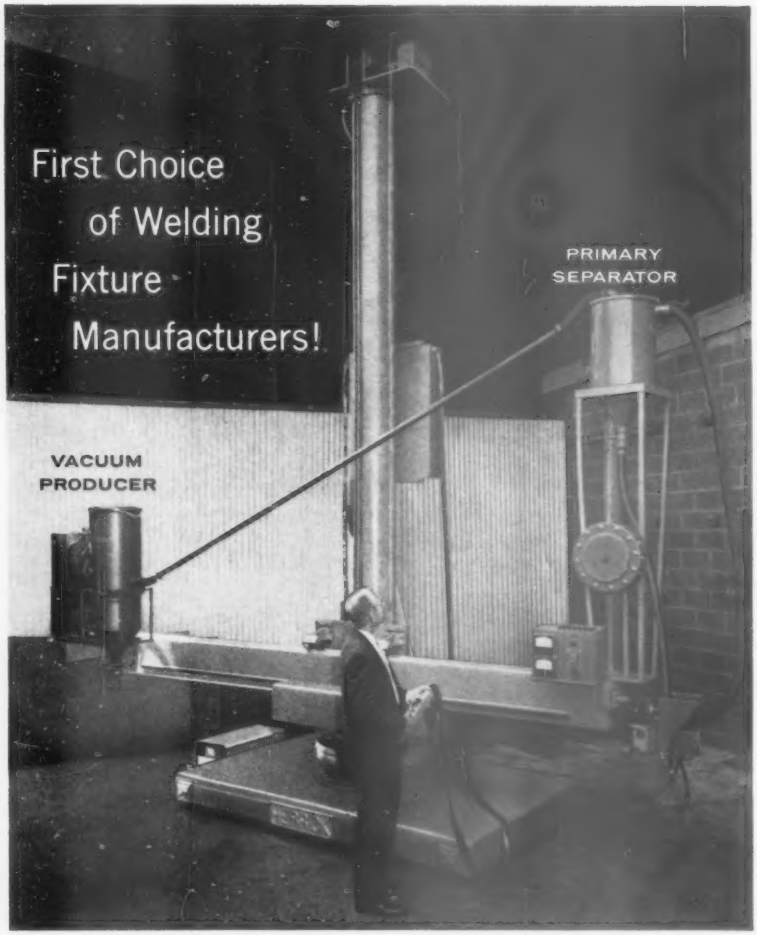
This welding set-up just *looks* difficult. Actually it's just one of thousands that you can work out with standard Mallory electrodes and holders that you can get from a Mallory distributor near you.

The upper holder is a 500 Series Heavy Duty offset water cooled holder, with a double bend Mallory 3 electrode with pointed nose. The lower holder is a 300 Series "Premium" Heavy Duty water cooled holder, also fitted with a double bend Mallory 3 electrode. All parts are standard, all readily available, all economically priced.

You'll save yourself time, money and worry, by letting your Mallory welding distributor solve your "special" set-ups with the hundreds of standard Mallory holders and electrodes he carries in stock. You'll get more welds per dollar, too. Mallory welding products are precision-made from specially developed Mallory alloys . . . incorporate unique designs which assure cool operation, long production between dressings.

**MALLORY RESISTANCE WELDING PRODUCTS ARE AVAILABLE FROM AUTHORIZED DISTRIBUTORS LOCATED IN ALL PRINCIPAL CITIES**

**For More Information Circle No. 73 on Reader Service Card.**




# INVINCIBLE UNITS

## Automatically Reclaim Flux

This automatic ram type manipulator made by C. B. Herrick Manufacturing Corp., Cleveland, is used for welding steel plate bridge girders. Mounted on the carriage, an Invincible Flux Recovery Unit travels with the welder along the full length (up to 130 feet) of the girder. It recovers all unfused flux . . . removes powder . . . and returns slag-free, dust-free flux to the welder automatically, in a continuous flow.

Fixture manufacturers—and users—specify Invincibles because they are engineered specially for handling abrasive materials and for continuous operation. Their rugged construction assures years of full-time operation—no loss of production time.

Savings in reclaimed flux alone pay their cost in a few months, even weeks. In addition, Invincibles save costly man-hours over manual methods, speed-up production, minimize rejects.

In 14 standard automatic and manual models (1½ to 7½ H.P.). Accurate free surveys of your submerged arc welding operations can be made on short notice. Resident engineers in all principal cities.

***Send for Invincible Flux Recovery Equipment Folder.***

**INVINCIBLE VACUUM CLEANER MFG. CO.**
DOVER, OHIO

**For More Information Circle No. 57 on Reader Service Card.**


*continued from page 30*

in vacuum.

Root of new brazing problems is the fact that the very elements which impart strength, oxidation resistance and corrosion resistance to new base metals as elevated temperatures are the same elements which often impair brazing properties of filler metals. The summary says nickel-base alloys have been found superior in high-temperature joining.

A comprehensive list of commercially available nickel-base brazing alloys is provided. Other subjects reviewed include methods of heating, brazing atmospheres, fluxes, and deoxidizing agents, brazing applications.

## Electric Welding

*"Linde Electric Welding Library" from Linde Company, Division of Union Carbide Corp., 270 Park Avenue, New York 17, New York, no charge.*

One of the industry's most complete libraries of technical papers on electric welding is being offered by Linde Company, Division of Union Carbide, which has developed many of the manual, semi-, and full-automatic arc welding processes used today.

The library contains process and application details on short arc welding, Mig and Tig welding and spot welding, submerged arc welding, $CO_2$-flux arc welding, and plasma arc welding, cutting, and surfacing. These papers have been presented at meetings of technical societies and have been published in industrial journals.

## 1961 List of ASTM Publications

The American Society for Testing Materials offers a 62-page list of their publications. More than 300 items are fully described, 40 of which are new. All publications are listed by title and subject. An order blank is bound into the catalog. The list is free from American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.

IN SERVICE . . . and operating at full capacity, one hot process sedimentation tank, 42 feet in diameter with a ¾ inch shell; ASME Code inspected and certified, empty weight just over 150 tons. Fabricated and erected for a major steel producer.

**fabricators** for industry, with quality and service born of experience in meeting exacting standards. Construction and warehousing facilities provide a balanced steel service.

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**YOUNGSTOWN, OHIO**

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YOUNGSTOWN, OHIO
Engineering—Erecting—Contracting
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***For Speed, Facilities, and Experience, send your blueprints to Lasker . . .***

- High pressure water tube boilers; heat exchangers and pressure vessels to code or specification
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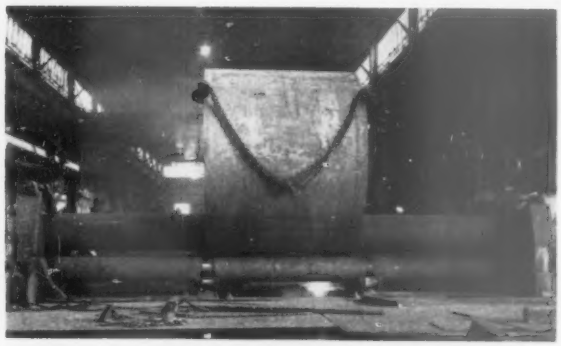

Forming 1035 steel 3-inches thick. 12-feet ID—over 10-feet-long.

## Specialists in

large, economical fabrications. Over 50 years experience in design and fabrication. Equipped with X-ray apparatus and stress relieving furnaces.

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Transforms any fork lift truck into a safe, efficient mobile overhead lifting unit.

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## Swiss Flame Cutter Proves Important Advantages in American Plants

Get the facts about Gloor *Expeditor*—the most versatile, reliable, and easily used cutting machine you can add to your plant. Advantageous for welding shops, experimental departments, to supplement larger and slower equipment—in fact wherever metal is fabricated and time is important. Many exclusive advantages, superior engineering and craftsmanship. Cuts direct from drawings. Free demonstration anywhere.

GLOOR EXPEDITOR

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All sizes. All good. All dependable.
Nothing fantastic about how they work.
They just weld good like they should.
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# We build 'em as though we were going to buy'em ourselves!

Know a better guarantee of quality?

**HARNISCHFEGER**
*Milwaukee 46, Wisconsin*
P&H WELDING PRODUCTS DIVISION

## WELDING AT WORK

*to do the job better and cheaper*

# Welding helps build the "Steel Mill of the Future"

DETROIT: Significant structural and functional advances highlight Great Lakes Steel Corporation's new 80-Inch Hot Strip Mill that will go into operation this year. It is said to be the world's fastest and most automated rolling mill. Speed of handling is built into every inch of the 20-acre steelworking complex now nearing completion in River Rouge.

Great Lakes Steel is a division of National Steel Corporation, which is carrying on a $300 million expansion and modernization program, part of which is the 80-inch "Mill of the Future."

### LATEST CONSTRUCTION TECHNIQUES

Structurally, designers and contractors are making best possible use of latest construction methods, with emphasis on in-the-shop welding and high-tensile bolts in preference to conventional riveting. The mill buildings have more welded girders than projects of comparable size. The results? Impressive economies in time and cost.

Whitehead & Kales, Detroit, has the prime steel contract. R. C. Mahon, Detroit, is supplying part of the 15,000 tons of structural steel as a subcontractor. United Engineering and Foundry is general designer of the mechanical apparatus, equipment, and foundations. United is coordinator of overall construction.

The mill stretches away from the busy Detroit River in six parallel aisles spearheaded by the main hot strip mill extending 2,160 feet. Bays differ from the customary 20-to-25-foot width. They are 48 feet in the mill building and 64 feet in the furnace area. Truss spans are 120 feet in the slab preparation yard and coil storage buildings, 106 feet in the mill aisle and maintenance and shop areas.

One of W & K's major assignments was fabricating 17,200 feet of runway girders capable of supporting fast-moving cranes with capacities up to 125 tons. The larger runway girders are 88 inches deep for the 48-foot spans and 102 inches deep for the 64-foot spans. One 96-foot span required a girder of 126 inches.

### AUTOMATIC WELDING

W & K uses a massive submerged arc welder to fabricate these girders. It can make a 5/8-inch fillet weld in a single pass.

The rail-mounted welder serves two beds of girders set at a 45° angle on either side. The machine makes a continuous 5/8-inch fillet weld on each web-flange plate joint, completing two girders in eight passes. W & K engineers contrived to have the first girder welded on the up run while its mate was being lifted from its bed, swung around the reset for the return pass. The result was continuity of production with maximum use of the welder. Only manual welding in the in-shop girder fabrication phase was on web stiffeners.

Aside from strength advantages of welding, the W & K approach saved untold man hours by eliminating costly operations like riveting flange holes for angles and web-plates, as well as punching and reaming.

W & K also used welding exclusively for all jack trusses and building columns. The jack trusses run alongside the crane girder. They carry the intermediate columns used to support the roof trusses, when they occur, and provide a stiffening companion structure for the long crane girders. Not a single hole was punched or drilled in the main shaft of the main building columns.

# Got a Welding Problem? Read...

*How* The Waylite Company adds at least a year to the service life of their clam buckets by Hard Surfacing the lips with McKay Hardalloy 48 Electrodes.

*How* McKay Stainless Steel Electrodes help Bird Machine Company speed production of their continuous filtering equipment.

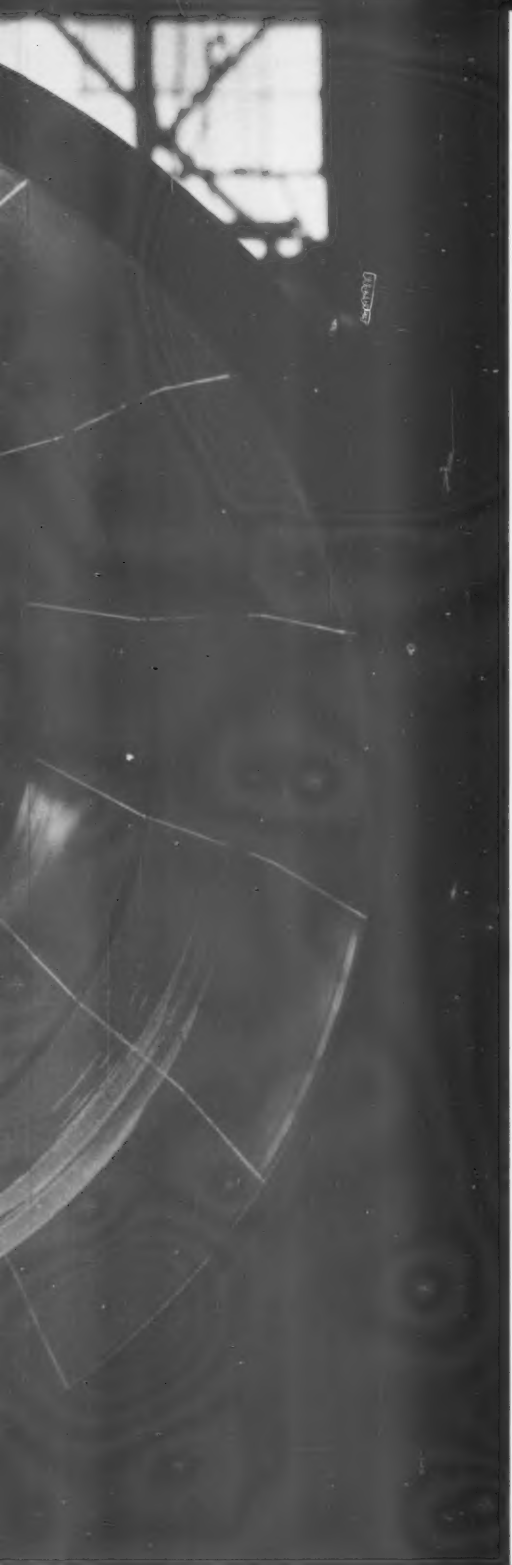
*Why* The Brighton Corporation has used McKay DC Titania Stainless Steel Electrodes exclusively for the past 16 years in fabricating food processing vessels.

## ABOUT BIRD MACHINE COMPANY

*Bird Machine Company was founded in 1910. Its employee force: three people who manufactured paper mill machinery. The company now has more than 400 employees. Bird Machine builds a line of 14 paper mill machines which accounts for approximately half the company's sales. The other half is in the field of liquid-solids separating equipment which the company started to manufacture in the early 1930's. Bird also manufactures KaMeWa controllable pitch propellers for marine applications, and markets them through Bird-Johnson Company.*

## APPLICATION DATA

**The precision engineered, continuous filtering equipment manufactured by Bird Machine Company is welded with McKay Stainless Electrodes to provide the strength needed for withstanding high operating speeds. Three sizes of these Electrodes are used in fabrication: 1/4", 3/16" and 5/32".**



# McKAY
## STAINLESS STEEL ELECTRODES

***...consistently meet the high standards of Bird Machine Co. and help speed production of continuous filtering equipment***

Meticulous—that's the word for describing production practices of the Bird Machine Company, a leading manufacturer of precision-engineered, continuous filtering equipment at South Walpole, Massachusetts. "We don't short-cut quality anywhere," is the statement plant superintendent Fred Baker uses to define his company's attitude toward materials and manufacturing.

"McKay's Stainless Electrodes consistently meet our standards," he added, "helping us manufacture only high quality, high performance products."

A conveyor with spiral-shaped stainless steel blades, welded with McKay Electrodes, forms the heart of each Bird filtering unit. This conveyor rotates within a bowl, at speeds ranging from 500 rpm to 6000 rpm, depending upon the size of the unit.

"The smooth, rapid application of McKay Electrodes helps speed production," said production assistant Thomas Tapley. "The small amount of spatter thrown off during welding reduces production time because less grinding is required on completed weldments. This is important when you consider how fussy we are about cleanliness of finished machinery."

Mr. Tapley pointed out also that weldments made by using McKay Electrodes always have proved strong enough to withstand the high operating speeds of Bird equipment.

Providing quality, trouble-free welding electrodes is only half the story of any McKay application. Other half: McKay's close personal service in helping select the correct Mild Steel, Stainless Steel, Low Hydrogen, or Hard Surfacing Electrodes and Welding Wires. Your nearby McKay distributor or representative has the product—and the service—to serve your needs.

*"Our filters may eventually require repairs as a result of extremely corrosive applications," said production assistant Thomas Tapley of Bird Machine Company, "but we have never received a customer complaint of breakdown due to a weldment failure. This trouble-free performance is a compliment to the quality of McKay Stainless Steel Electrodes."*

*See back page for McKay Special Services to the Welding Industry*

THE McKAY COMPANY

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- ARC-WELDING ELECTRODES
- WELDING WIRES
- INDUSTRIAL CHAIN
- TIRE CHAINS
- AUTOMATIC WELDING EQUIPMENT

### ABOUT THE WAYLITE COMPANY

*The Waylite Company was founded in 1932. From its central offices in Chicago, Waylite directs operations at steel plants in Duluth, Minnesota; Bethlehem and Norristown, Pennsylvania; Youngstown, Ohio; and of course, the Chicago operation described here.*

### APPLICATION DATA

**Using McKay Hardalloy 48 Electrodes (3/16-inch in diameter), the weld deposit of Waylite's buckets follows a cross-hatch pattern. On bulldozer pads, cutting edges and cutting blades, the reinforcing follows a pattern of parallel rows. On the front end loaders, two beads following the length of the blade are connected with short strokes about 1½ inches apart.**

# McKAY

## HARDALLOY 48 ELECTRODES

### *. . . save $2210 in rebuilding costs for Waylite Company, Chicago, Illinois*

"Hard surfacing our clam dipper buckets with McKay Hardalloy 48 Electrodes adds at least a year to the service life of each piece of equipment," declared Mr. Joseph Merkum, plant superintendent at The Waylite Company's operation at the Chicago steel mill of Interlake Iron Corporation.

Waylite processes slag for lightweight aggregate used in manufacturing concrete blocks. The slag is so abrasive that without hard surfacing the lips of their clam buckets would have to be replaced after only six months wear. Each bucket would also have to be rebuilt at a cost of about $820.

"Today, a total investment of $250 for McKay Hardalloy 48 Electrodes and labor assures us 18 months of maintenance-free service," said Mr. Merkum. "Rebuilding costs for same period would amount to about $2460."

"There's quite a savings when you compare $250 with $2460—$2210 in fact! And I believe the same savings can be applied to the other equipment we use, such as the bulldozers and front end loaders."

Like Mr. Merkum, you too can realize low maintenance costs and long service life from equipment that must be hard surfaced. McKay has a full line of performance-proved Hard Surfacing Electrodes and Automatic Wires that are ideal for use on all types of equipment.

McKay Hardalloy 48, for example, has won recognition as an ideal high-speed Hard Surfacing Electrode for applications where severe abrasion is a major factor. The McKay Company offers a wide selection of other grades of Hard Surfacing Electrodes to meet virtually any service requirement. If you want good, sound hard surfacing, look to McKay.

*"The slag we process is about as abrasive a material as you can find," said Mr. Joseph Merkum, plant superintendent for The Waylite Company's Chicago operation. "That's why we hard surface parts of our equipment with McKay Hardalloy 48 Electrodes. Hardalloy 48 weld metal can really take the punishment of this continuous abrasion."*

*See back page for McKay Special Services to the Welding Industry*

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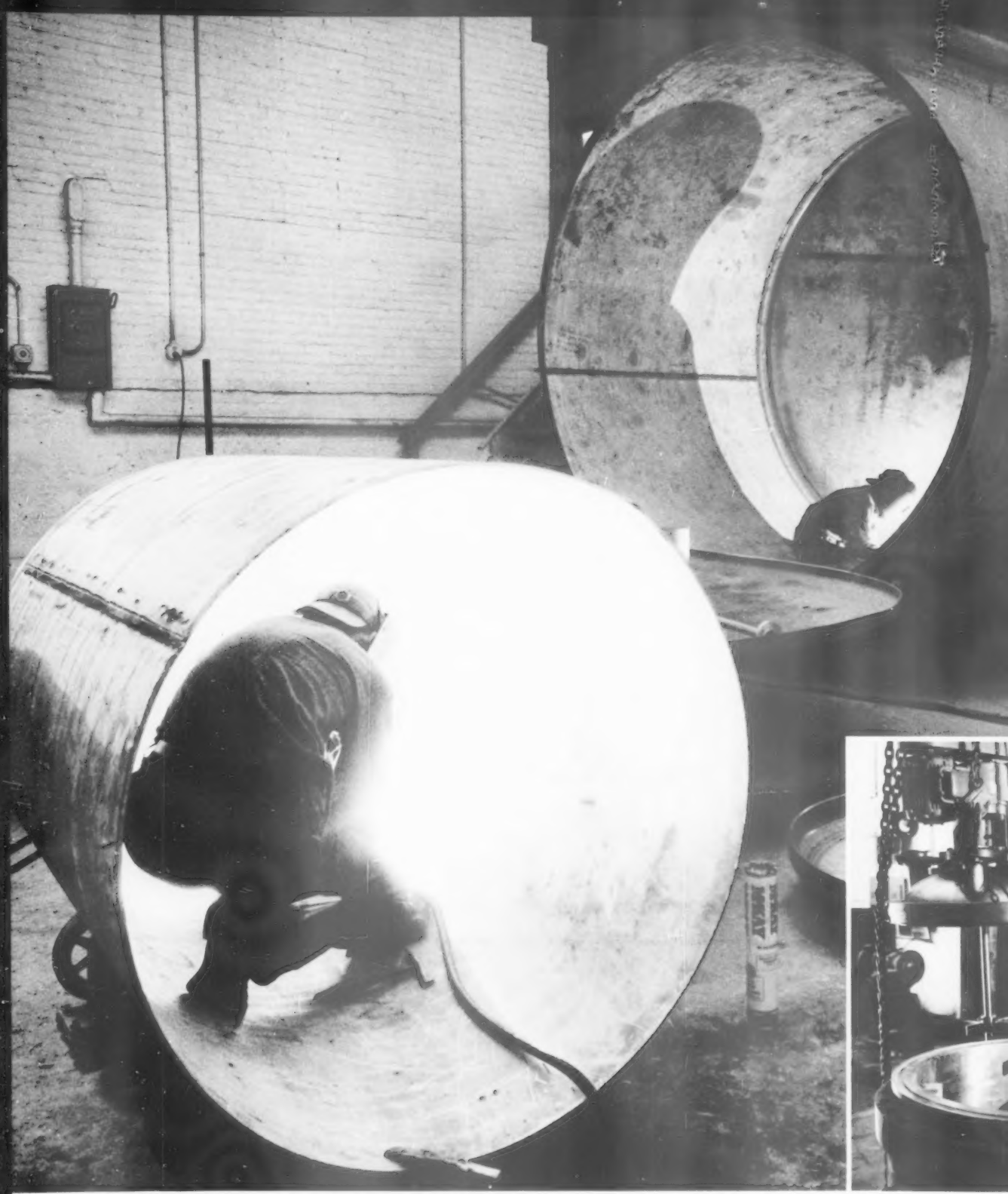

### ABOUT BRIGHTON CORPORATION

*Brighton Corporation was founded in 1914 by Alvin Hock, Sr., who started with a workshop only 15 feet square. Today Brighton Corporation employs 100 persons who work in a one-story building containing 70,000 square feet of production area. The Hamilton Kettle Division manufactures food processing equipment. In addition to manufacturing processing equipment, Brighton Corporation designs and produces laboratory equipment and pilot plants for major companies throughout the nation.*

### APPLICATION DATA

**Among the Brighton products that McKay DC Titania Stainless Steel Electrodes help fabricate are fractionating towers, evaporators, resin kettles and reaction tanks. Fabrication starts with beveling the edges of the metal sheets to be joined. The sheets are then carefully fitted and welded.**

# McKAY DC TITANIA STAINLESS STEEL ELECTRODES

## *. . . compile 16-year record of excellence during exclusive use by Brighton Corp.*

Compiling an enviable, 16-year record of excellence as an exclusive supplier is a pretty rare feat. Even the "best of the best" can slip up—maybe only a bit—somewhere over the years.

But it's a different story when you look at the fine relationship between The McKay Company and Brighton Corporation in Cincinnati. Just ask Paul L. Hock, vice president of the firm which manufactures specially designed equipment for the food, chemical, drug, paint and varnish industries:

"We have used McKay DC Titania Stainless Steel Electrodes exclusively for the past 16 years in handling 80 percent of our fabrication work —the manual welding of stainless steel. Although we have checked competitive materials repeatedly, we have never even considered switching from McKay. Their Electrodes, by far, still remain best suited to our operation. By using McKay Electrodes, we eliminated porosity problems, obtained consistently good bead contour and achieved crack-free welds."

Porosity-free welds, a must at Brighton Corporation, are essential for tight gasket fits and processing vessels. Sound welds and good bead contour reduce costly grinding and polishing work.

Brighton relies on a wide range of grades of McKay DC Titania Electrodes for their specialized stainless steel, and stainless steel to mild steel applications.

McKay DC Titania Electrodes might be just what you need for economical, quality production. Brighton Corporation has banked on these McKay products and service for 16 years. Let the McKay representative show how you too can become a satisfied user.

*"In addition to the complete satisfaction with McKay's Stainless Steel Electrodes for the last 16 years, we have been impressed with McKay's fast service," said Mr. Paul L. Hock, vice president of Brighton Corporation. "McKay kept us supplied with hard-to-find Electrodes during the war and they continue to serve us efficiently today."*

*See back page for McKay Special Services to the Welding Industry*

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- WELDING WIRES
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# SPECIAL SERVICES TO THE WELDING INDUSTRY

## TECHNICAL SERVICE

McKay service does not stop with the production of quality Welding Electrodes and Wires. Technical Service personnel, a complete electrode development laboratory, and extensive testing facilities are available to assist in developing workable solutions to many welding problems.

## HARD SURFACING FIELD SERVICE

If you're looking for on-the-spot engineering counsel and demonstrations for the solving of Hard Surfacing and parts rebuilding problems, McKay Hard Surfacing Field Engineers can help you. These men are experienced, qualified field engineers who possess the specialized hard surfacing welding technology and skills needed to economically solve costly and often complex surfacing and rebuilding problems.

## Other "HELPS" . . . FROM THE McKAY COMPANY

### ELECTRODE LITERATURE

■ **Hard Surfacing Catalog**—Contains full information on all McKay Hardalloy Hard Surfacing Electrodes and Tube-Alloy Welding Wires, plus check list of 500 applications.

For your copy circle No. 1 on Literature Request Card

■ **The Welding of Mild Steels**—Catalogs specifications, operating characteristics, properties, uses and other data about the McKay Mild Steel, Low Alloy, Low Hydrogen Electrodes.

For your copy circle No. 2 on Literature Request Card

■ **Welding of Stainless Steels** — A 24-page book which provides detailed data on chemical analysis, mechanical properties, corrosion resistance and types of electrodes available for welding stainless steels.

For your copy circle No. 3 on Literature Request Card

### AUTOMATIC WELDING EQUIPMENT LITERATURE

■ **Micro-Matic Bulletin MI-402** — provides illustrations, description and operating characteristics of the Dual Head Micro-Matic rebuilder, a completely automatic machine for hard-metal resurfacing of tractor, crane or shovel rollers, idlers and wheels.

For your copy circle No. 4 on Literature Request Card

■ **Track-O-Matic Bulletin TR-302**—describes and illustrates the Twin Track-O-Matic, an automatic rail rebuilder which simultaneously can rebuild top surfaces or edges of both tractor rails.

For your copy circle No. 5 on Literature Request Card

■ **Multi-Matic Bulletin MU-502**—contains data and illustrations on the Multi-Matic Universal Rebuilder. This machine is designed for longitudinal and circumferential surfacing of a wide variety of construction, mining and general industrial equipment.

For your copy circle No. 6 on Literature Request Card

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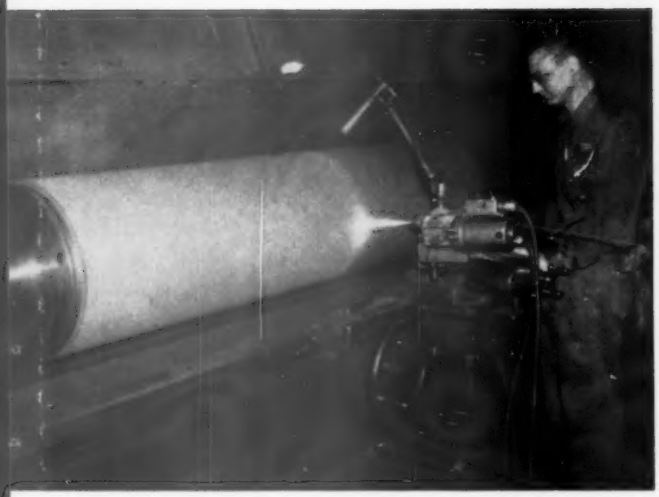
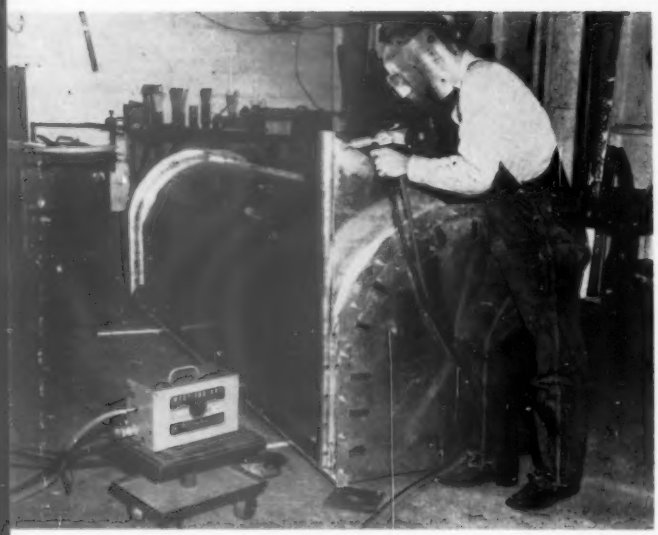


## Protecting aluminum rolls

THE ALUMINUM ROLL being metallized here is used for transporting a thin plastic film. The application is similar to the more common one of textile plant sand rolls. Surface preparation for spraying consists of mechanical cleaning followed by a thin coat of self-bonding molybdenum. A .020-inch-layer of stainless steel is applied over this. This is a new roll which will be used as-is and not finished. The heavy-duty electric-drive flame spraying machine was built by Metco, Inc.



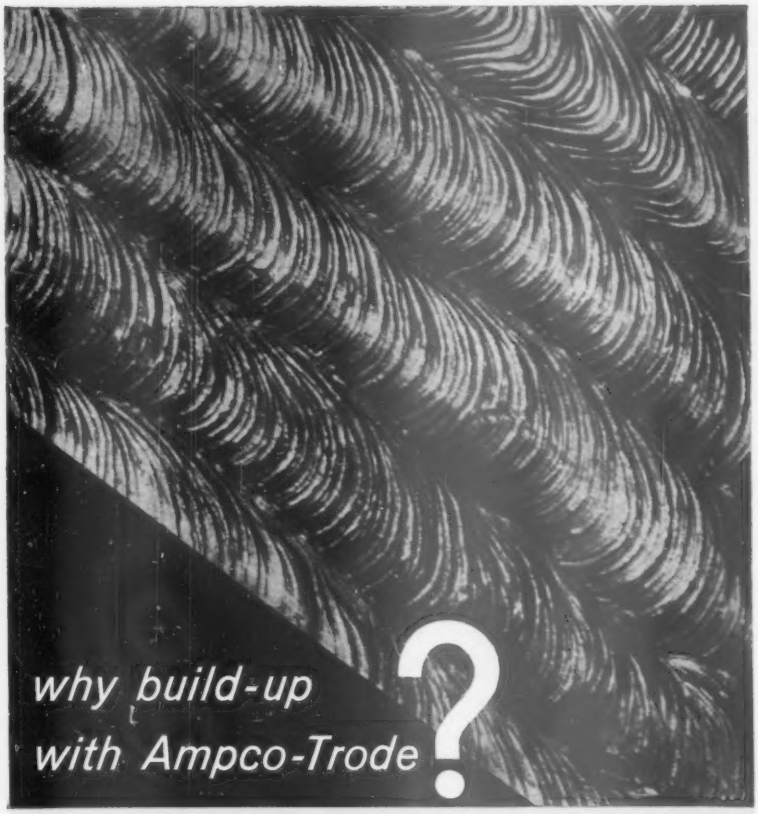
## Semi—automatic welding speeds tank fabrication

KANSAS CITY, MISSOURI: Tanks made of 3/16-inch aluminum sheet are being welded twice as fast at the Gordon Johnson Equipment Co. The reason is that the consumable electrode process is now being used on 58 feet of welded joints instead of manual tungsten arc welding. Johnson's production manager, R. L. Lewis, says welding current was reduced and that five cubic feet of argon are saved every hour. Mr. Lewis adds that less operator training is required. The welding equipment consists of a No. SP 110 Westing-Gun and CC Monitor, products of Westinghouse Electric's Westing-Arc Department.

## Cutting torches speed building demolition

CLEVELAND, OHIO: Demolition of the old Cleveland Press building is being expedited by cutting torches made by Harris Calorific Co. Harris Wrecking Company (no relation to the manufacturer) explains that in this kind of demolition it is important to use equipment that provides automatic lighting, as well as proper balance for one-hand operation. Cutting the structural steel calls for unusual positions, with the operator's safety often depending on free use of one hand.

The torch in this case has a tip which cuts up to 1½-inch-thick steel, using propane and oxygen.




## THE ANSWER IS MONEY!

When you surface with Ampco-Trode®, you're actually salting away cash. By building up surfaces with **aluminum-bronze** electrode, you can add years to the life of machine parts that are subjected to corrosion, abrasion, or sliding friction. There's less down-time on the machine . . . less premature replacement of expensive parts.

There are five Ampco electrodes specifically designed for build-up: Ampco-Trode 10, 160, 200, 250, and 300. They offer you a hardness range from 160 to 380 Brinell: resist sliding wear, shock, squashing out, erosion, cavitation-pitting, corrosion. Available in coated or bare filler rods.

Order from your nearby Ampco distributor, or mail coupon below, today.

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AMPCO METAL, INC.
Dept. 176J, Milwaukee 1, Wis.

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W-1s6

For More Information Circle No. 19 on Reader Service Card.


*continued from page 45*

**BROKEN ALUMINUM** spring hanger costs $80 to replace, but only $10 to repair. That's why this . . .

# Truck line saves money with Tig welded repair

CHARLESTON, W. VA.: Bell Lines, Inc., a large trucking company, had accumulated damaged aluminum truck parts valued at $3,000. These were considered a total loss until Andrew Williams of Virginia Welding Supply Co. saw them. Williams recommended repairing them by Heliarc welding. Two days after the Heliarc torch was installed, every discarded part had been reclaimed. This one salvage job paid the entire cost of the torch and power unit, plus the overhead for labor and consumables.

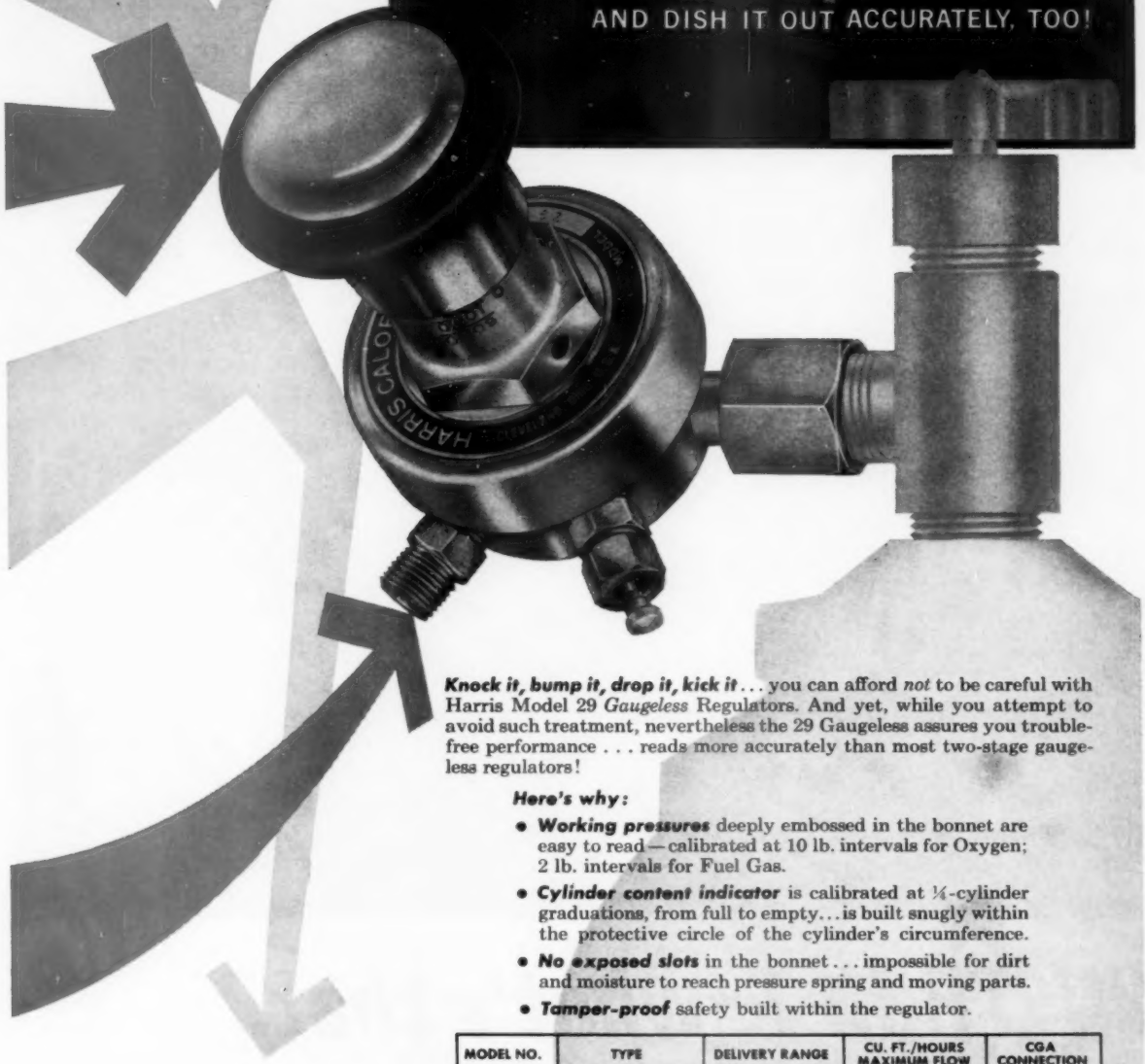
Bell used to have local welding shops repair damaged aluminum parts. This permitted a slight dollar savings, but a loss of time. When time was important, the damaged parts were usually scrapped and replaced with new factory parts.

Now, Bell Lines uses the Heliarc torch for 75 percent of all their welding repairs. Dollar savings on parts has been tremendous since the new equipment was installed. A $450 aluminum transmission case can be welded in three hours at a cost of less than $40. Only 30 minutes labor is needed to salvage a $125 bell housing.

Bell Lines estimate this one torch will eventually handle 95 percent of their repair work because truck and trailer manufacturers are using more aluminum parts every year.

# HERE'S A NEW REGULATOR THAT CAN TAKE IT!...

AND DISH IT OUT ACCURATELY, TOO!




***Knock it, bump it, drop it, kick it*** . . . you can afford *not* to be careful with Harris Model 29 *Gaugeless* Regulators. And yet, while you attempt to avoid such treatment, nevertheless the 29 Gaugeless assures you trouble-free performance . . . reads more accurately than most two-stage gaugeless regulators!

***Here's why:***

- ***Working pressures*** deeply embossed in the bonnet are easy to read—calibrated at 10 lb. intervals for Oxygen; 2 lb. intervals for Fuel Gas.
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|---|---|---|---|---|
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| 29-P | Acetylene | 0-15 | @ 15 lbs. 350 | 510 |
| | Propane | 0-26 | @ 26 lbs. 400 | |
| 29-D | Acetylene | 0-15 | @ 15 lbs. 350 | Alt. 300 |
| | Propane | 0-26 | @ 26 lbs. 400 | |
| 29-ER | Carbon Dioxide | 0-26 | 400 | 320 |

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**For More Information Circle No. 31 on Reader Service Card.**

OCTOBER, 1961 Welding Design & Fabrication

**JOHN BRADNER,** seated, and Chief Engineer Don Goodwill.

*"We didn't start it, but we're surely a part of the big switch in the machine tool industry."*

***John A. Bradner,***
*chairman of the board,*
*Lees-Bradner Company,*
*Cleveland*

# We're changing our castings to weldments

WHO LIKES CHANGE? Few people want it if what they're doing seems to be going along well; they find too many good reasons to continue what they are doing. This frame of mind is a poor substitute for good management and has no place in business; competition forbids it.

Take the machine tool industry. For years cast iron was the only material considered. Some manufacturers still think that you have to have a cast base or a housing to make a good machine tool. They've found their rut and can't see over the top of it.

It's a shame. Progressive tool builders are beginning to enjoy the advantages of welded design: No patterns to capitalize, store, or maintain; easy design changes without scrapping expensive patterns. Lees-Bradner is that kind of a machine tool builder. It took soul-searching, then 10 years of creative designing. It was worth it. John Bradner tells what happened:

***The machine tool industry is a traditional user of castings. What made you break with tradition by going to welded design?***

Several good reasons: Our patterns were wearing. They needed a lot of maintenance and, sooner or later, we would have to replace them. New patterns are dear—some cost as much as $10,000.

Another thing, the high cost of patterns stopped us from improving our machines. A lot of good ideas keep coming along in gear cutting. We had to wait until competition demanded a change in design. In effect, we collected improvements until we had enough to justify scrapping the patterns. This was not good. It kept us and our customers from enjoying the advantages of better design.

Something else made us welding conscious: Persuasive welding equipment sales engineers. Ten years ago they showed us several advantages of weldments:

*continued on next page*

"We were forced to collect improvements until we had enough to make scrapping a costly pattern worthwhile. This hurt us and it hurt the machine tool buyer."

economy, strength, lightness, easy change. And the salesmen reminded us often of these advantages.

There was still another reason for changing: Good gray iron foundries were getting harder to find. Limp business curves wounded some foundries, killed others. We had to go farther from home to get our work done.

***What did you expect from weldments?***

The list is long. We expected to improve our machines as fast as improvements came along. We expected weldments to free us from the restriction of investment in patterns. We expected to be able to build a better machine to sell for less. We got all this, and more, with weldments.

***Did you switch to weldments on your own or did you have help?***

We had plenty of help; and the more we got, the better it got. However, the first drawings of castings we sent to the fabricator came back cloaked in welding details but designed like a casting. It was overweight, didn't begin to take advantage of welding.

We called the welding sales engineers to help. They did. The result was teamwork between our engineering department, the fabricator, and the welding sales engineers. The final weldment was wholly satisfactory, better looking, and less expensive than the first.

***Did you consider making your own weldments?***

Yes, we did, but we decided to wait until we had enough business to support a fabricating department. Another advantage to farming out our work was speed. Our fabricator was well-equipped, well-established, reputable. He got us started quickly, something we could not have done ourselves. We're a machine shop; it would take us time to become a good fabricator. And after 10 years, we still send our work out. Our fabricator is doing a good job at a reasonable price; we'd be foolish to change.

***With so many castings to choose from, how did you decide which one to convert first? How did you select succeeding ones?***

Don Goodwill here (Lees-Bradner chief engineer) and I picked the jobs. We climbed way out on the limb looking for ways to reduce costs and improve our product. First we converted the base of our single-spindle hobbing machine. It was a good one to start on, because the casting cost a lot to machine but it was fairly simple.

The next step: The guards and support posts that attach to the single-spindle base. The only job of a guard, you know, is to keep cutting oil in, people out. The cast posts weighed too much and took much too much machining and assembly time. We changed them in two steps. First, we replaced the cast posts with welded posts, keeping the sheet metal guards. Finally,

**JOHN A. BRADNER,** affable and active chairman of the board of The Lees-Bradner Company, Cleveland, leads a brimming business and personal life. He took the Board helm in 1960 after a fruitful term as company president. Progressive ideas and company growth have been company policy under his leadership—the same kind of ideas that are displayed in this article.

John is a fit leader. He knows machine tools and their market. He served hitches in the engineering, machine shop, purchasing, sales and service, and administrative departments of the company.

John graduated from MIT in 1935 with a B Sc in mechanical engineering. He has taken many courses and attended innumerable seminars since leaving college. He insists that Lees-Bradner people "go back to school" to get a new slant and new ideas.

He's been in the Navy too. After a tour as lieutenant in the Reserve Corps, he merited a Certificate of Commendation for his services. He is past president of the Ohio Department, Reserve Officers Association, has held important posts, area and national, in the National Metal Trades Association. He was recently nominated Treasurer of the National Board of NMTA. John served on several committees of the National Tool Builders Association. He also served on the Machine Tool Advisory Committee of the National Security Resources Board—the peacetime successor to the War Production Board. He is one of the founding members of the Young Presidents Organization.

John Bradner thoroughly enjoys his hobbies: boating, photography, and hi-fi. In his own words he speaks "gutter" French and "face-slapping" German. They've been good enough, however, to see him around the world.

"Business and better methods have taken their toll on foundries. You have to go farther and farther away from home to find a good one."

we got rid of the posts altogether. We simply (and effectively) held the guard sheets on the welded base with metal clips welded to them.

The single-spindle base and guard convinced our whole organization that there was a lot to be gained with weldments. Now for something more ambitious

"How the devil do you justify scrapping a $10,000 pattern?"

and more complicated: The base of our multiple-spindle hobbing machine. We wanted to reduce the costs of this one drastically.

And we did. The welded multiple-spindle base was a complete success. And besides the base, there were the cast guard supports to get rid of. There were eight to a machine—each a machinist's dream, if not an accountant's. We used to plane them, turn them, drill and tap them, and at last, assemble them to the welded base. Getting rid of the posts saved a lot of time and money. Company traditionalists were impressed.

Our customers were even more impressed. Many were already using weldments in their own products and didn't need convincing. Also, we found that welded bases were more durable in shipping and handling. When you drop a casting it usually breaks. A weldment might bend if dropped, but you can straighten it.

***Now that you have converted many castings to weldments, are you satisfied with the gains? Are there advantages you had not counted on?***

We are completely satisfied and we've earned a lot of extras with them. Let me express our satisfaction another way: If a casting can be converted, we'll do it.

Talk about extras: Our machines look much better than they did when we used castings. Another thing, welded bases don't leak. Castings often do. Leaky bases are more troublesome than you'd think. You don't usually find a leak until a machine is completely assembled and filled with cooling and lubricating oil. If there is a leak, the machine has to be torn down, plugged, then rebuilt. This is expensive.

We can fabricate to closer tolerances than we used to be able to cast. Weldments need much less machining than castings. On some castings we used to allow an extra inch of metal to allow for pattern shift, so the part would clean up and fit. It cost a lot of money to buy this extra metal, and it cost a lot more to machine it off.

Weldments, we found, are cheaper to finish than castings. When the fabricator ships us a base, it's ready to paint. Castings take a lot more work. First, you have to fill the pits, bumps, and rough spots. Then you grind the casting smooth, clean it, and, finally, paint it. The rolled steel you use for fabrications is naturally smooth, it doesn't need this work.

***Besides better looks and less work, were there other rewards to welded design?***

Yes. Weldments are outside expense items; you don't have to sink money into them as you do for patterns. We freed our money for better uses. Another thing, since we no longer use patterns, we don't have to maintain them, and we freed a lot of fine space.

***Don, you were deeply involved in changing your castings to weldments. Did you have any misgivings about it?***

I did. I wondered if we could get weldments that were as rigid as castings. The full weight of the machine rests on the centerpost of the base. If the base deflects, the machine won't cut accurately.

We knew that gray iron castings wouldn't move after machining, but we didn't know about weldments.

"We get our weldments fabricated on the outside. The price is right, workmanship is good. Why should we build them ourselves?"

But we found that properly designed welded bases did stay in line. In fact, we spiked our competition's guns on this point: We said, "Know how to design for welding and the base will never go out of line."

***Do you think the machine tool industry will step up its use of weldments?***

Sure it will. The trend is under way. Oh, there are some that still think castings are good, weldments bad. There's always resistance to change. But some changes have already been made, and good ones. Indeed, the customers like weldments, and that fact is speeding the change. The user already knows the advantages of weldments. He uses them for his own products.

*turn the page to see how machine tools are changing*

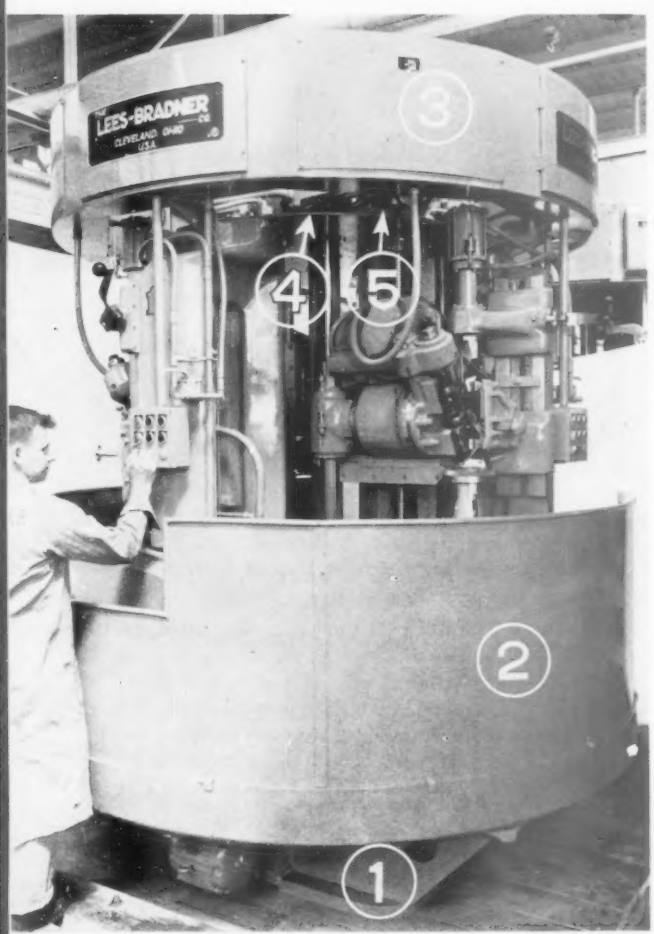
# *How Lees-Bradner makes better machine tools for less . . . . .*

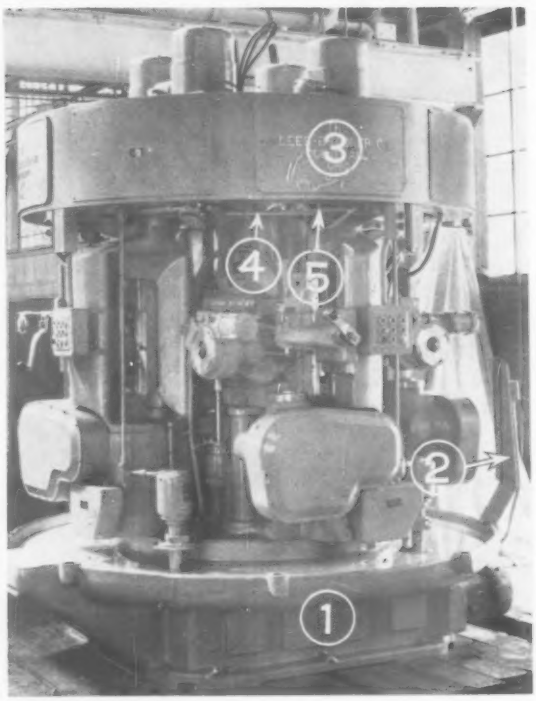
## ROTARY SPINDLE HOBBING MACHINE

**BEFORE - Cast (right)**

**1** Base: 35.1 hours of machining, fitting, and finishing. Danger of shipping damage considerable.

**2** Splash Guards (not shown) and Posts: Eight cast posts (one shown) required for each hobbing machine cost $1,628.80 for planing, drilling, and tapping. Fabricated posts cost $1,100.00 a machine. Sheet metal guards from first design retained.




**3** Top Housing and Controls: Expensive aluminum castings; made access to machinery difficult.

**4** Top Ring: Cost $752.55 to machine heavy cast plate.

**5** Motor Plate: Crowded arrangement forced a cluttered operating area of machine.

**AFTER - Welded (left)**

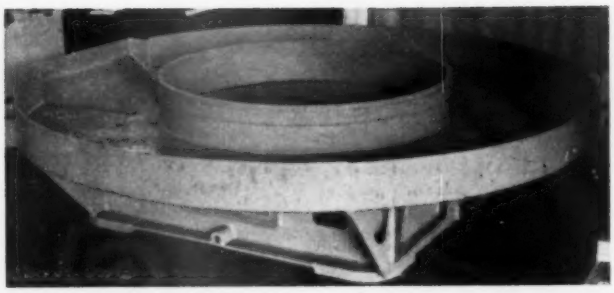
**1** Base: 2.8 hours to machine and finish. Savings: 32.3 hours per machine. Advantages: Better looks, lightweight, more damage-resistant, stronger.

**2** Splash Guards: Posts eliminated, saving $1,628.80 a machine in cast posts, or $1,100.00 in fabricated posts. Advantages: Better looks, more effective design; clips welded to guard sheets hold them firmly on welded base, while permitting much easier removal.

**3** Top Housing and Controls: Sheet steel housing. Much less expensive, better looking, and readier-access.

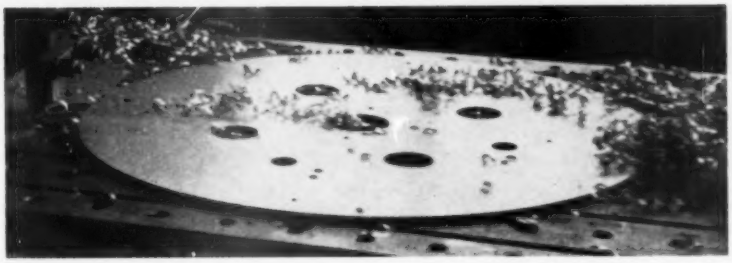
**4** Top Ring: Made from boiler plate. Saved $284.95 a machine in material and machining labor.

**5** Motor Plate: More compact design permitted putting control circuits at top of machine, keeping the operating area clear.

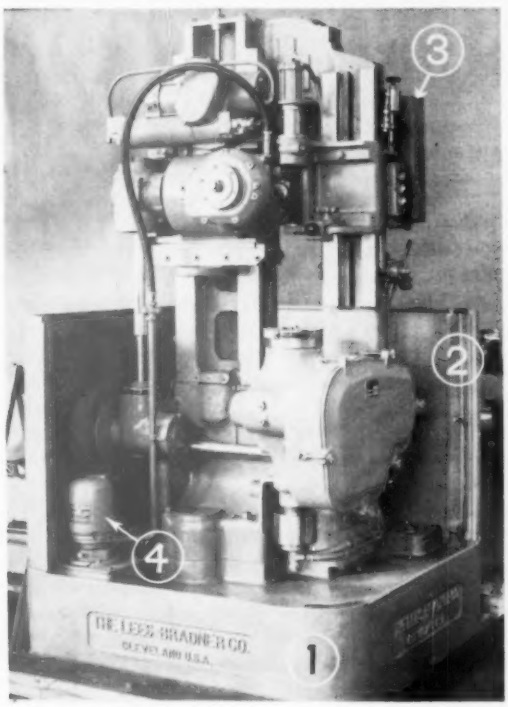


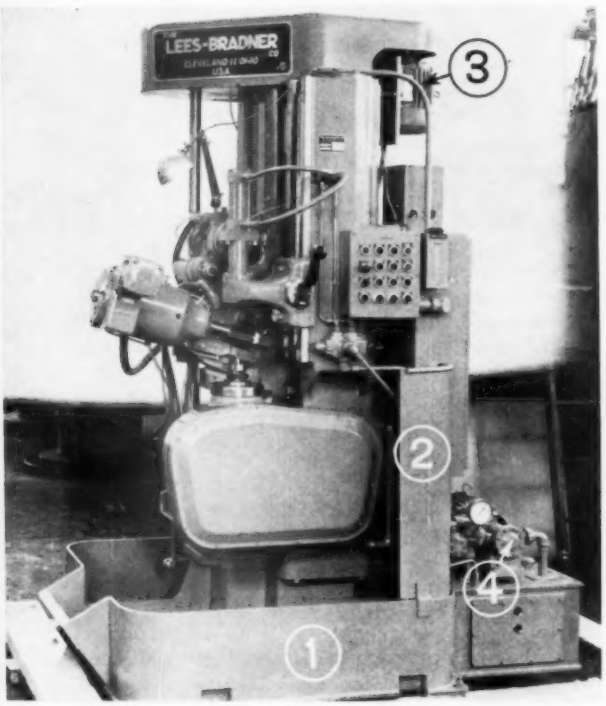
**MULTIPLE SPINDLE BASE:** Casting (above), weldment (above right). This study in contrasts shows the smooth, functional lines you can get in weldments that are impossible in castings. Cast iron is brittle, so you have to use thick sections. Steel is naturally strong and ductile, therefore sections needn't be as thick.

**TOP PLATE** of the multiple spindle machine (right) is now made of boiler plate, not from a casting like it used to be. This saves hours of machining and crowds the machinery less. The steel plate is stronger, therefore thinner.



## SINGLE SPINDLE HOBBING MACHINE




**BEFORE - Cast**

**1** Base: 17.8 hours of machining, fitting, and finishing.

**2** Splash Guard and Posts: Four posts cost $166.96 a machine. Posts had to be planed, drilled, and tapped, then laboriously hand-fitted.

**3** Spindle Drive Motor: Used up operating room at bottom of machine.

**4** Cutting Fluid Pump: Motor in front of machine; and hydraulic lines in way of operator.

**AFTER - Welded**

**1** Base: 9.9 hours to machine, fit, and finish. Saved: 7.9 hours.

**2** Splash Guard: Posts eliminated saving $166.96 a machine; better looking and easier to remove besides.

**3** Spindle Drive Motor: Moved to top of machine, out of the way.

**4** Cutting Fluid Pump: Moved to back out of the way. Welded base forms sturdy, leak-proof, tank.

A METAL SHOW FEATURE REPORT

*To fabricate this up-and-coming defense metal, you'll need to know . . .*

# The techniques for welding columbium

by **W. J. LEPKOWSKI, R. E. MONROE, and P. J. RIEPPEL,** Battelle Memorial Institute, Columbus

**IN BRIEF: The alloys that make columbium endure heat also make it harder to weld. But here are the ways that have worked.**

THERE'S BEEN A LOT of interest in columbium and its alloys for defense applications. Why? Because it has excellent properties at high temperatures. No wonder the Defense Metals Information Center at Battelle asked us to report on the weldability of columbium.

You fabricate and weld columbium much the same as you do metals like titanium. The trouble is, there's not much information published on welding columbium. We actually anticipated welding problems and avoided them by projected known information. Pure columbium isn't strong and heat resistant when it's hot. What gives it hot strength and oxidation resistance: Alloying other metals with it.

Columbium melts at about 4,380 F. Unalloyed, it has the lowest density of any refractory metal—half that of tantalum. It has low neutron-capture cross section: This makes it ideal for nuclear jobs.

You can strengthen columbium and its alloys by cold working it. But you lose this strength when you weld. The best way to strengthen it, then, is with alloys. Of course, the stronger you make it, the harder it is to cut and bend. But this is a small detail considering what you gain.

These are columbium's solid-solution strengtheners: Molybdenum, tungsten, tantalum, and vanadium. They go into the mix, lose their identity, but make themselves felt. Zirconium and hafnium strengthen columbium by dispersion hardening. Dispersion hardening bolsters columbium like vitamins do people.

Columbium has a great hunger for oxygen, nitrogen, carbon, and hydrogen at 400 F. and above. Columbium is stronger with these contaminants in it, but a lot less ductile than it should be. So you have to weld it in a way that prevents contamination by these elements.

## WELDING PURE COLUMBIUM

The gas-shielded arc is widely used for welding columbium. We'll discuss the other processes used to weld it in a future article: Resistance, electron-beam, and ultrasonic. In gas shielded welding, the tungsten arc is most widely used. Consequently, there's more information on welding columbium by TIG welding than by any other process. But the data is still scarce; and without mechanical properties to work with, the researcher must use bend tests to evaluate the weld properties of columbium. And the variables in welding columbium—especially as to amounts of contaminants, make accurate conclusion-drawing hard.

You can TIG weld columbium in air or in a gas-filled chamber. If you do it in air, you must use a gas backup and a trailing shield to get ductile welds. If you eliminate the trailing shield, for example, you also eliminate weld ductility. Welds made in a vacuum-purged helium chamber are ductile. Many bead-on-sheet welds made this way have been bent 180 degrees without breaking.

If you weld faster, but don't change the heat, the weld will be less ductile. There's little difference between chamber-made welds and those made in air with shields: One's as hard as the other. The average hardness of the weld and the heat-affected zone for 0.031-inch-thick metal was about the same for all welding techniques. Bend-ductility varied, however, probably because surface contamination varied. You'll notice another thing in welding columbium: It takes more shielding gas than metals like the nickel-base alloys and the stainless steels.

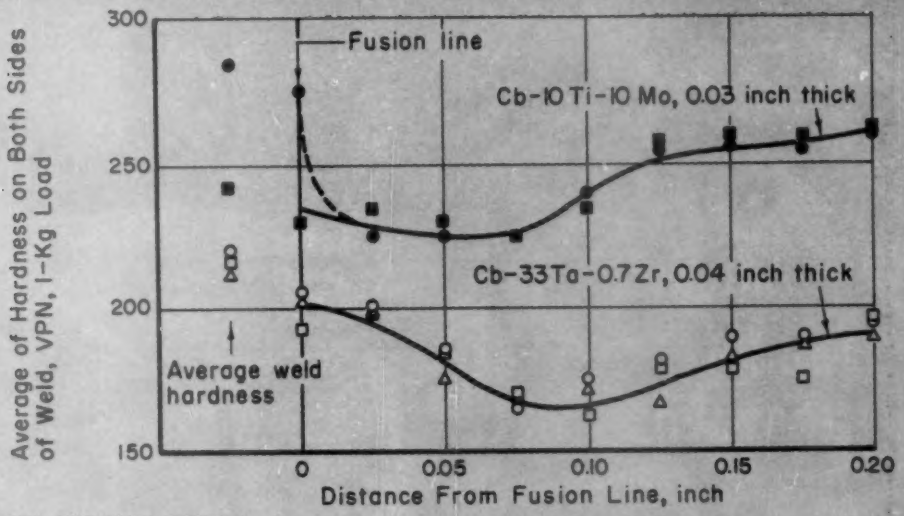
If you weld columbium in a chamber you'll get better welds if you evacuate and back-fill the chamber, than if you flow-purge it; the atmosphere is less contaminated. And of the contaminants, nitrogen appears to do the most damage.

There has been little said about consumable electrode (MIG) welding of columbium because less of it has been done. Some researchers have studied the effect of argon and helium on the shape of consumable welds. They've found that you get a high, rounded bead with argon, a little better shape with helium.

## WELDING COLUMBIUM ALLOYS

We know more about tungsten arc welding the alloys than any other fusion process. We've studied the effects of the alloying elements on weldability. These alloys can be grouped:

## Here's what Battelle learned about several Cb alloys




**WELD DATA AND BEND RESULTS**

| Symbol | Current, amperes | Arc Voltage | Speed, ipm | Argon Flow Rate, cfh Torch | Trail | Backup | Minimum Bend Radii or Angle* | Remarks |
|---|---|---|---|---|---|---|---|---|
| ● | 90 | 10 | 20 | Chamber | | | 0°, 0°, 0° | Clean surfaces on all welds. The titanium-containing alloy was tarnished slightly on top surface. |
| ■ | 90 | 12 | 20 | 14 | 14 | 6 | 0°, 0°, 0°, 0°, 0°, 0° | |
| ○ | 170 | 13 | 20 | Chamber | | | >0.5T, >0.5T, 180°, 180° | |
| □ | 170 | 12-13.5 | 20 | 20 | 20 | 4 | >1T, >1T, >1T, >1T | |
| △ | 220 | 12-14.5 | 40 | 20 | 20 | 4 | 4.5T, 4.5T, 2T, 1T, 180° | |

*Bend tests made by using successively sharper radii to determine minimum (in terms of thickness, T) before cracking. Bend angle noted if no bending occurred (0°) or if no failure occurred and sample could be flattened (180°).

- The alloys that neutralize the bad effects of air-Ti, Hf, and Zr.
- The alloys that strengthen columbium—Mo, Ti, Ta, W, V, Zr.
- The alloys that detract from weldability—Co, Cr, Th, and Al.

We found that the lean alloys were easy to weld. We melted arc-melted metal with a d.c. arc, on straight polarity, in a helium-filled chamber. Before welding we vacuum annealed each metal at 2,730 F for an hour. All of the welds in these alloys were porous at the fusion line.

Bend tests show that tungsten, vanadium, and zirconium raise the brittle-ductile transition temperature. One percent hafnium, lowers the transition temperature. We couldn't determine what the exact changes were, however, because the interstitial compounds varied.

Researchers have welded FS-82 (Cb, 33 Ta, 0.72 Zr) and F-48 (Cb, 15W, 1 Zr) alloys and tested them by bending. The variables of some of the first studies were postweld heat treatments. Operators welded the alloys in a helium chamber and also with helium shielding in air. The welds on the F-48 alloy were ductile. They used Cb, 1 Zr filler wire and heat treated the sample for two hours at 2,500 F in a vacuum. Brittle failures in other specimens were attributed to carbide precipitation at the grain boundries of the heat-affected zones.

At Battelle, we studied the Cb, 10 Ti, 10 Mo and the Cb, 33 Ta, 0.7 Zr alloys to learn how shielding affects welds. The Cb, Ti, Mo weld was hard, probably because of gettering in the weld chamber. All the welds were sound. These inspections said so: radiography, dye penetrant, and metallography.

### IS THERE A FUTURE FOR CB?

There certainly is. Columbium alloys with hot-strength and oxidation resistance are being developed rapidly. It's the job of researchers to keep up with these and future developments with good welding techniques. Aware of the need, the U. S. Air Force has requested research on the welding of the columbium alloys. Part of the researcher's job will be to determine the effect of impurities on Columbium welds, then establish tolerances for them. • •

A METAL SHOW FEATURE REPORT

*the brazing alloys*

*and the metals you braze*

| Nominal Composition, weight per cent | | | | | | | | | | Approximate Brazing Temperature, °F |
|---|---|---|---|---|---|---|---|---|---|---|
| Ag | Cu | Mn | Ni | Pd | P | Si | B | Fe | Cr | |
| 72 | 28 | | | | | | | | | 1450-1600 |
| 85 | | 15 | | | | | | | | 1800-1900 |
| 75 | | 5 | | 20 | | | | | | 2050 |
| 64 | | 3 | | 33 | | | | | | 2200-2250 |
| | 100 | | | | | | | | | 2050 |
| | | 68 | 32 | | | | | | | 1850-2000 |
| | | | 90 | | 10 | | | | | 1750-1900 |
| | | | 91 | | | 4.5 | 3 | | | 1950-2000 |
| | | | 93 | | | 4 | 2.6 | | | 1950-2150 |
| | | | 82 | | | 4 | 3 | 3 | 7 | 1880-2000 |
| | | | 71 | | | 4 | 3.8 | 4 | 16.5 | 1900-2100 |
| | | | 71 | | | 10 | | | 19 | 2175 |

| | C | Si | Mn | Cr | Ni | Co | Fe | Mo | W | Al | Ti | Others | Brazing Method |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **IRON BASE** MULTIMET (N-155) | 0.2 max (cast) 0.08-0.16 (wrought) | 1.0 max | 1.0-2.0 | 20.0-22.5 | 19.0-21.0 | 18.5-21.0 | Bal. | 2.5-3.5 (wrought) | 2.0-3.0 | | | Cb & Ta 0.75-1.25; $N_2$ 0.1-0.2 | Dry Hydrogen Atmosphere |
| **NICKEL-BASE** UDIMET 500 | 0.15 max | 0.75 max | 0.75 max | 15.0-20.0 | Bal. | 19.0-20.0 | 4.0 max | 3.0-5.0 | | 2.50-3.25 | 2.50-3.25 | S 0.015 max B 0.008 max | |
| M-252 (J-1500) | 0.10-0.20 | 0.3-1.0 | 0.5-1.5 | 18.0-20.0 | Bal. | 9.0-11.0 | 5.0 max | 9.0-11.0 | | 0.5 -1.25 | 2.25-2.75 | | |
| INCONEL ALLOY 700 | 0.16 max | | | 13.0-17.0 | Bal. | 24.0-34.0 | 4.0 max | 1.0-4.5 | | 2.5 -3.5 | 1.75-2.75 | | Vacuum |
| RENE 41 (J-1610) | 0.09 | | | 19.0 | Bal. | 11.0 | 0.2 max | 10.0 | | 1.5 | 3.0 | | |
| **COBALT BASE** J-1570 | 0.20 | | | 20.0 | 28.0 | Bal. | 2.0 | | 7.0 | | 4.0 | | |

# Brazing the cobalt alloys? Here's how

by **W. J. LEPKOWSKI** and **R. E. MONROE**, *Battelle Memorial Institute, Columbus, Ohio*

**IN BRIEF:** The cobalt-containing alloys can stand a lot of heat and corrosion and still stay strong. Here are guides to good brazes in them.

DON'T FORGET—when you braze the cobalt-containing alloys, the filler metal is more important than the base metal. This isn't true in welding these alloys (see January, 1961 issue, page 37). The base metal and filler metal are equally important in welding.

Cobalt alloys, remember, are iron-, nickel-, or cobalt-base. You join them the way you do the austenitic stainless steels, but with local differences. The brazing alloy you use depends on how hot a part gets in use.

Brazing alloys are classified according to their major elements. Silver and copper alloys work best at low temperatures; the nickel-base alloys best at higher temperatures. Most silver-base brazing alloys are not strong enough, or resistant enough to oxidation, to be used above 700 F. Palladium strengthens and protects the silver-base alloys, permitting their use at higher temperatures. Copper-base alloys are satisfactory up to 200 F, but no higher.

For hotter service, use the nickel-base alloys. Nickel-phosphorus, for example, is good through 1,000 F. For still hotter jobs, use a nickel-silicon-boron alloy. If the heat is really on, use a brazing alloy with chromium in it. Chromium strengthens the alloy and protects it up to 2,000 F.

Nickel-base alloys diffuse with the base metal. If the base metal is thin, diffusion may dissolve it. If the metal is thick enough, diffusion will probably strengthen the braze and make it harder to remelt.

Most parts for high-temperature-use are brazed in pure, dry hydrogen (dew point —60 F). Alloy N-155 and Haynes Alloy No. 25 braze readily in a hydrogen atmosphere. However, some of the superalloys, like ones with titanium and aluminum, form oxides that prevent brazing, even in hydrogen. But there are other ways to braze these alloys: vacuum, plating, and brazing-alloy preplacement.

Vacuum braze J-1570, Udimet 500, M-252, Inconel alloy 700, and Rene 41 to get the strongest joints. In fact, alloys that are difficult to braze in hydrogen will usually braze easier in hydrogen, and the joints will be stronger. Brazing barely affects the metals that are the strongest when hottest, like Haynes Alloy No. 25, Rene 41, and J-1570. • •



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## *Know these facts about A-286...*

**TABLE 1 / Typical Room Temperature Mechanical Properties of Solution Treated A-286**

| Treatment: | 1 Hr. at 1800°F. Oil Quenched |
|---|---|
| Tensile Strength: | 90,000 Psi (105,000 Max.) |
| Yield Strength: (0.2% offset) | 40,000 Psi |
| Elong. in 2" G.L. | 40% (25% Min.) |
| Hardness: | $R_B$ 75 - 90 |

**TABLE 2 / Typical Room Temperature Mechanical Properties of Aged A-286 Showing Effect of Solution Treatment Temperature**

| Treatment: Solution Treatments as Indicated, Oil Quenched, Aged 16 Hrs. at 1325°F. | | | |
|---|---|---|---|
| Solution Temp. | Strength in Psi. x $10^{-3}$ | | % Elong. |
| | Tensile | Yield | |
| 1650°F | 155 | 108 | 27.5 |
| 1800°F | 145 | 100 | 25 |
| 1900°F | 145 | 93 | 25 |
| 2050°F | 141 | 88 | 22 |

**TABLE 3 / Typical Elevated Temperature Properties of Aged A-286 Showing Effect of Solution Treatment Temperature**

| Treatment: Solution Treatments as Indicated, Oil Quenched, Aged 16 Hrs. at 1325°F. | | | | |
|---|---|---|---|---|
| Solution Temp. | Test Temp. | Strength in Psi. x $10^{-3}$ | | % Elong. |
| | | Tensile | Yield | |
| 1650°F | 1000°F | 130 | 98 | 16 |
| 1650°F | 1200°F | 112 | 100 | 23 |
| 1650°F | 1300°F | 94 | 89 | 20 |
| 1800°F | 1000°F | 131 | 87 | 18 |
| 1800°F | 1200°F | 103 | 88 | 13 |
| 1800°F | 1300°F | 86 | 84 | 11 |

Allegheny Ludlum developed the A-286 alloy about 10 years ago as an improvement on the German Tinidur alloy. Among other superiorities is the fact that A-286 does not have the notch sensitivity inherent in Tinidur. The alloy is outstanding for fabricated weldments like jet engine, afterburner, and gas turbine components.

The nominal composition of the alloy is: carbon, 0.08 max; manganese, 1.6; silicon, 0.65; sulfur, 0.030 max; phosphorus, 0.040 max; chromium, 15.00; nickel, 25.00; molybdenum, 1.25; titanium, 2.10; vanadium, 0.30; aluminum, 0.20; boron, 0.003. Balance is iron.

Although A-286 is more than 50 percent iron, there is enough nickel in it to stabilize austenite at all temperatures. As a result, no transformation occurs in the solid form. It is rich enough in alloys to give excellent corrosion resistance up to 1300°F in all atmosphere encountered in jet engine applications. Its oxidation resistance has been compared to Type 310 stainless and is satisfactory for continuous service up to 1500°F. Above 1800°F, the scaling rate is higher.

Titanium makes the alloy heat treatable. As a result, A-286 attains its strength entirely by a two-stage heat treating cycle of solution treatment and aging. $Ni_3Ti$ is the equilibrium phase of the coherent transition structure responsible for the precipitation hardening. Although other precipitates may form they do not appear to contribute to the hardening phenomenon. The $Ni_3Ti$ phase does not form at temperatures above 1650°F and when formed by overaging at a lower temperature readily redissolves at 1700°F. This has established a stress relief temperature or a minimum solution treatment temperature of 1650°F. Coherent hardening is optimum after heating for a period of time between 1300-1350°F after solution treatment and the recommended aging cycle is 16 hours at 1325°F. The resultant properties are stable and hardness is not reduced by subsequent

# Techniques for welding and fabricating the A-286 high temperature alloy

by **L. J. HULL**, *chief metallurgist, Ryan Aeronautical Co., San Diego*

**IN BRIEF:** The author says the trend is toward using alloys designed for specific purposes, to get a given strength and temperature requirement without under-designing or over-designing. The A-286 alloy is one of them.

A-286 IS AN ALLOY that was developed to be a high strength, heat resisting alloy, one that could be produced in large quantities and one whose iron-base would show certain alloy and price economies. The high strength properties are developed by heat treatment and properties, particularly ductility in the center of larger sections, is acceptable at room temperature up to 1200-1300°F.

### WELDING

A-286 is difficult to weld. Certain precautions must be taken. Here is a partial list of ideal conditions for fusion welding:

- Stress-free solution-treated parts.
- Absolute cleanliness of joint area.
- Perfect metal-to-metal fit at joints.
- Fixtures with inert gas back-up to hold parts with perfect fit in alignment.
- Joints designed for automatic welding.
- A minimum of starts and stops.
- Joint areas separated to keep weld areas apart.
- Similar thickness and mass of metal on either side of the joint.

long time exposures to temperature of 1300°F and lower.

Test data shows that the hardening response is sensitive to the titanium constant even within the normal range of 1.90 to 2.30 percent. Since titanium has an extreme affinity for carbon, oxygen, and nitrogen, melting presents a problem in keeping the titanium free for its intended purpose. Similarly, processing during fabrication must be controlled to prevent loss of the effectiveness of this element.

## PROPERTIES

Table 1 shows the mechanical properties of solution treated material. This is the soft condition and A-286 is normally formed and welded after this treatment.

Table 2 shows typical mechanical properties after aging as affected by varying the solution treatment temperature. The higher strengths resulting from the lower solution temperature are also evident in short time elevated temperature tests (Table 3). Producers' data also shows that the strength varies in proportion to the titanium content and that the solution treatment temperature has less effect with lower titanium than high. The data also indicates that higher ductility, as measured by elongation and reduction of area, go along with higher strengths at the lower solution temperature.

In contrast, increasing the solution temperature over the range from 1650°F to 2050°F causes large increases in creep and rupture strengths. The penalty for this is a marked decrease in ductility at elevated temperatures.

A wide range of properties result from variations in heat treatment. It appears that alloy properties can be customized to an application. For optimum properties in A-286, a solution temperature of 1800°F for 1 hour and an age at 1325°F for 16 hours is recommended.

## AVAILABILITY

A-286 may be purchased to the following specifications:

AMS 5525A: Sheet, strip, and plate.

AMS 5735C, AMS 5736A or AMS 5737: Bars, forgings, mechanical tubing, forging stock, and heading stock.

A-286 is also covered by consumer specifications, such as the General Electric B50T12 and B50T46.

All these specifications call out minimum mechanical properties after heat treatment, including a stress rupture test.

## HEAT TREATING

Heat treating presents some special problems. One of these is the density change of A-286 during aging. An example of this is a bimetallic strip of A-286 spot welded to a strip of 19-9 DL. The coefficients of expansion of the two materials are nearly equal. After aging, the strip exhibits a permanent bow (with the A-286 on the concave side) that solution treatment alone does not produce. Measurements show this amounts to about 0.6 percent change in density and allowances for .001 inch-per-inch shrinkage during aging are necessary.

This phenomenon practically prohibits joining A-286 to any other material before heat treating. The shrinkage also causes another problem because it is not always uniform. Evidence indicates that residual stresses from machining or welding affect the direction and magnitude of shrinkage. As a result, fixtures are necessary in aging. This means designing a fixture that will allow some movement, since the density change cannot be prevented, but that will now allow distortion. It is possible to do this and in some cases corrections may be made to minor distortions by fixturing.

Carburization cannot be tolerated during heat treatment of A-286 since any extra carbon has the effect of reducing the titanium content of the alloy. Satisfactory atmospheres include a lean exothermic and a low carbon potential, endothermic gas. Neither will prevent the formation of a thin, adherent oxide film, but they will present scaling during solution treatment.

Assemblies can be solution treated and aged after welding. Although oil quenching following solutioning is recommended for heavy sections, experience has shown most sheet metal and light forging assemblies can be fan-cooled satisfactorily. Quenching distortion then rarely becomes a problem. Fixturing is generally restricted to the aging operation, if used.

The ideal fusion weld should show little or no crown, no cracks; it should be narrow, sound and free of inclusions and should exhibit parent metal properties.

Successful welds have been made using A-286 wire or Hastelloy W wire with automatic and manual tungsten arc methods. Joints made automatically with Hastelloy W wire have shown the least amount of defects. This filler metal is also preferred by operators for manual welding and weld quality has been superior to that of welds made with A-286 wire. The Hastelloy-W is as strong as the A-286 filler wire.

Metallic arc electrodes (16-25-6) have also been used.

Weld cracks occur in the weld and immediately adjacent to the weld. Because most of these defects occur after welding and before heat treatment, it appears that a hot short range sometimes allows insufficient strain to relieve cooling stresses. Recommendations for successful fusion welding should include the use of Hastelloy W filler metal (it may relieve the hot short condition) and an attempt to get ideal welding conditions.

As an aid to repair procedures, data from micro hardness surveys shows very little softening of the parent metal next to a simulated repair weld in fully hardened A-286. This procedure is not recommended as a general practice, however, because aged A-286 is harder to weld than solution treated material.

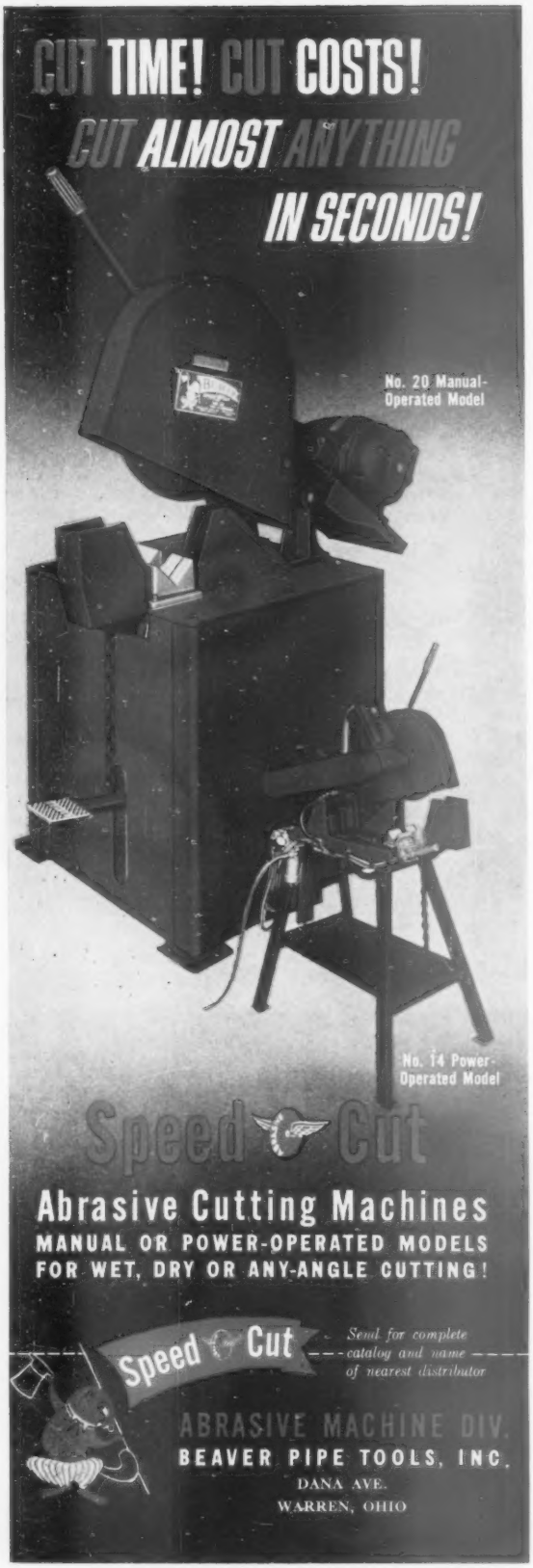
TABLE 4 / Results of Tensile Tests on Welds

TREATMENT: Welded, 1650°F, 1 Hour A.C.
Aged 1325°F — 16 Hours

| Weld Filler Wire | Test Temp. | Strength in Psi. x $10^{-3}$ | | % Elong 2" G.L. |
|---|---|---|---|---|
| | | Tensile | Yield | |
| A-286 | R.T. | 127 | 97 | 5.6 |
| Hastelloy W | R.T. | 126 | 93 | 5.9 |
| A-286 | 800°F | 107 | 85 | 4 |
| Hastelloy W | 800°F | 106 | 85 | 4 |
| Hastelloy W | 1000°F | 104 | 80 | 3.5 |
| Hastelloy W | 1200°F | 103 | 80 | 3.5 |

Resistance welding can be used on A-286. Welding details must be stress free and fit properly. Most experience has been with weldments made from solution treated

*please turn the page*




For More Information Circle No. 25 on Reader Service Card.

**A-286** *continued from page 59*

material and then heat treated. Tests on spot welds made with fully heat treated material show very acceptable results. Single shear tension tests on spot welded coupons gave similar values of about 55,000 to 60,000 psi shear when welded before or after heat treatment.

A-286 has also been resistance welded successfully to other high temperature materials.

### FORMING AND MACHINING

A-286 can be readily formed in the solution treated condition when the hardness is below RB90. It work hardens rapidly and stress relieving or annealing at 1650°F or higher may be required between stages on severe forming operations. The forming characteristics are similar to 19-9 DL or Type 410 stainless alloys. Strain cracking has not been a problem, but a stress relief treatment after forming is almost always advisable as insurance and to prevent adverse effects of residual stresses on the next operation.

Problems may arise when a critical amount of cold working results in germination during subsequent annealing or solution treatment. The resulting coarse and irregular grain size may seriously affect the ductility and other properties. This effect appears to be negligible at a solutioning temperature of 1650°F but a treatment of 1800°F may be necessary for creep and rupture strength. It is difficult to determine critical reduction in forming except by experience. As a comparison, it ranges around 5 to 10 percent in rolling. If there is trouble, the most practical solution is more frequent stages during forming in an attempt to stay below the critical range in reduction between annealing operations.

A-286 is an austenitic alloy that work hardens rapidly. As such, it is synonymous with difficult machining. It is slower to machine than the 300 series alloys, but with proper equipment and techniques it is machinable in both solution treated and aged conditions. The rate of metal removal may be increased if machining aged material, partially aged or over aged, or cold worked material.

General purpose nonferrous cemented carbide tools, such as Carboloy 883 or Kennametal K6, are satisfactory on lathes. Speeds of about 100 sfm and cuts of 0.010 inch or more with a 7° positive rake tool bit have been used successfully on solution treated material, after aging, speeds about double this have been used with deeper cuts but with a slight negative rake on the bit. End mills of T-15 high speed steel are effective for milling.

### HANDLING AND CLEANING

General shop practices and handling conditions that apply to stainless alloys also apply to A-286. Storage conditions are not as critical and sheet is transported and sheared like other similar materials.

As in many other precipitation hardening alloys, aged A-286 is susceptible to intergranular attack by pickling solutions strong enough to remove scale. Solution treated material has been descaled by a 2-stage treatment consisting of an oxidizing salt bath at 900°F followed by a 5 minute 20 percent sulfuric acid neutralization of the caustic salt and a 20 minute descaling in 35-40 percent $HNO_3$—4 percent HF at ambient temperature. Thorough cleaning before heat treatment makes it easy to remove scale afterwards. In many cases descaling may not be necessary or it can be done mechanically. • •



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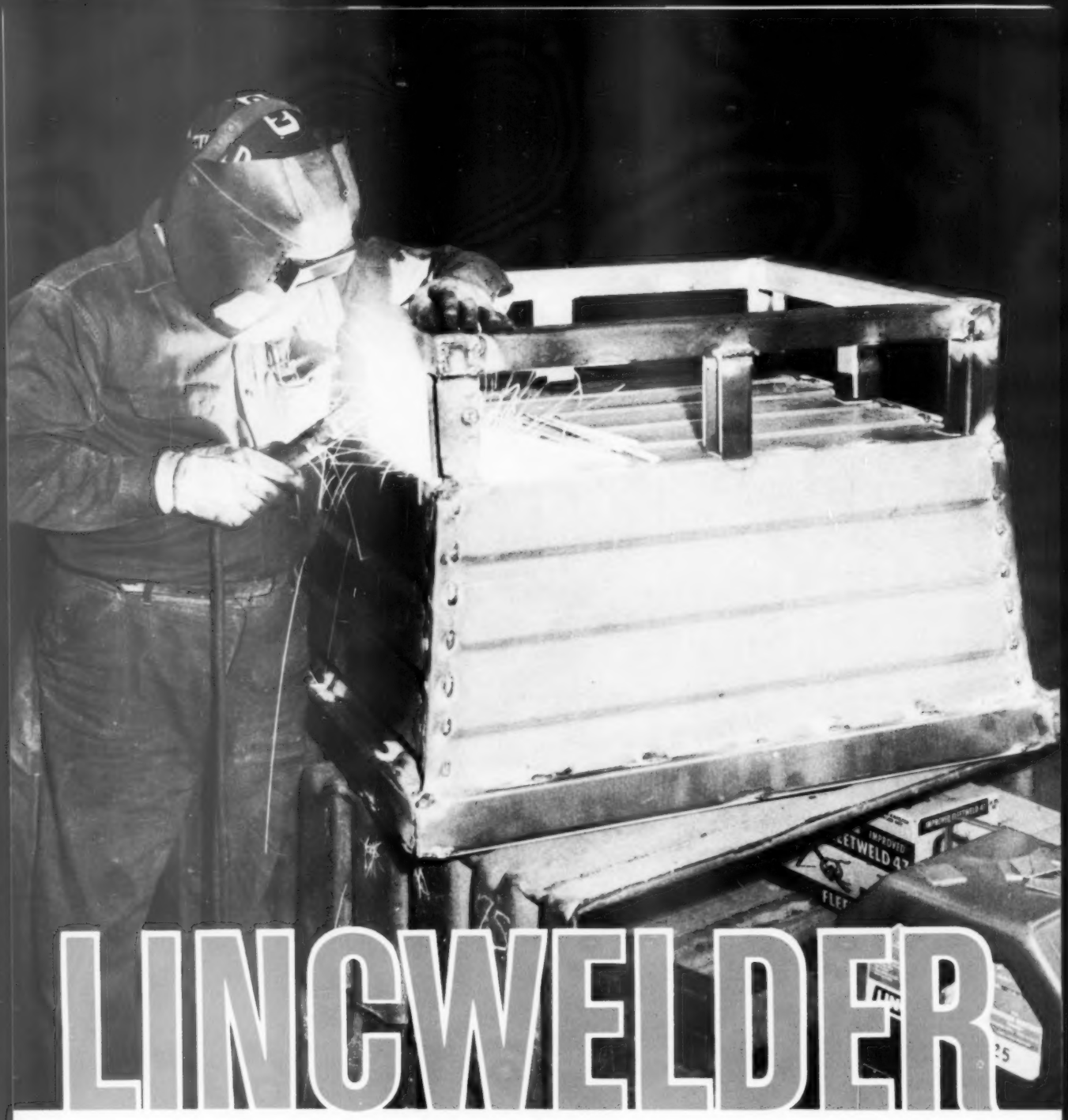


# LINCWELDER

You can use just about any welder made for light fabrication, repair or maintenance welding. You can, that is, if you're not too concerned with the job you'll get or what it will cost. Take a few moments, won't you, to read how Lincoln—**Lincwelders**—are specifically designed for this kind of work and how they can improve weld quality and reduce both your equipment and job costs.

# These are LINCWELDERS on the job

Light fabrication is simple with an AC-225-S **Lincwelder** because of its high current capacity, exceptional arc stability and high open-circuit voltage. Lets you handle iron-powder electrodes up to 5/16-inch in diameter. These usually require a much larger machine. This capability lets you increase production, lower your costs. There simply is no machine made comparable to the AC-225-S, and none which sells at a competitive price which can do so many jobs so well.

Automotive repair shop makes good use of AC-180-S **Lincwelder** for general repair and maintenance work. Machine operates on standard single-phase, 230-volt power, needs no special wiring. Operates all day for about 32¢. Its low initial price and low operating cost means years of low-cost, trouble-free service. Machine furnished complete with headshield, cables, ground clamp, electrode holder, sample electrodes, instructions . . . everything you need to weld.

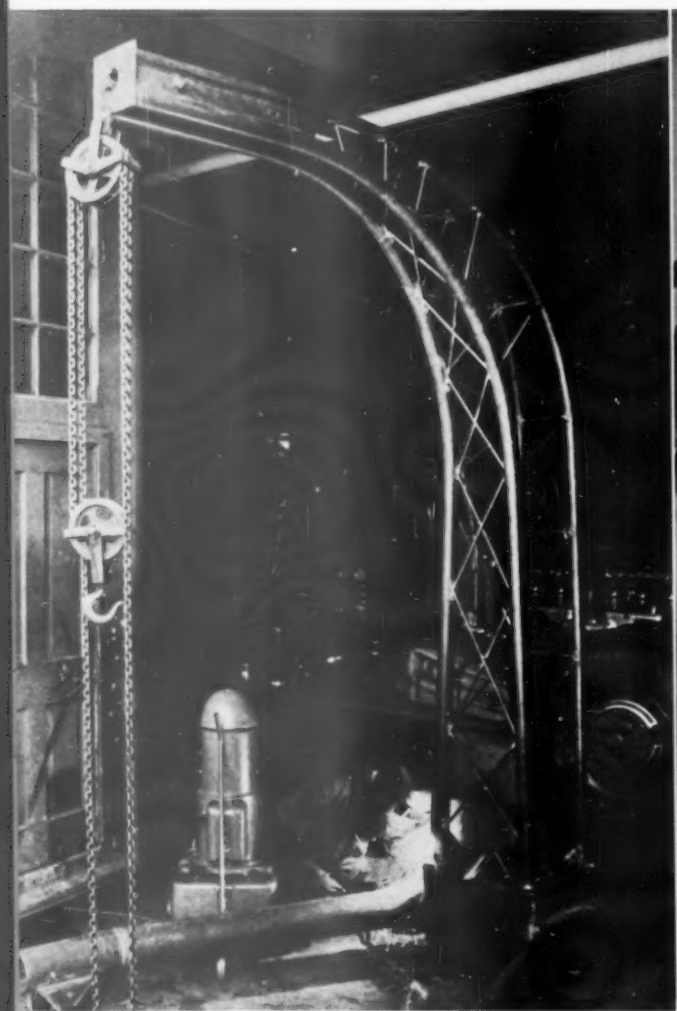
**Lincwelder** is a name applied to machines made for light to medium duty fabrication and maintenance. Two of these types of machines are discussed here. First, a DC, motor-generator, the second, an AC, transformer welder.

In the entire history of the welding industry, probably more men have been trained for "light-duty" work on **Lincwelder** motor-generators and have subsequently used them in more kinds of applications than any other welder ever made. Here's a breed of machines that is noted for delivering a sure, steady DC current. Here are machines equipped with dual continuous controls which let the operator set the exact current and voltage settings he needs to do a particular job according to his particular style. This kind of control lets the man get on top of his job quickly, produce better welds —faster—at less cost. These machines are just plain perfect for repair shops, garages, general maintenance departments, wherever DC welding is done on sheet metal, angles, channels and other light materials. And, of course, they can easily handle most stainless, non-ferrous and hardsurfacing jobs, too.

But maybe your shop uses one of the new electrodes that demands AC heat. If this is the case, you can get no finer AC transformer welder for light or medium-duty welding than the **Lincwelder** AC-180-S or the AC-225-S. Thousands of the smaller units have been sold for use in every conceivable type of application from the small captive job shop, the independents, and farms. No wonder. Here is a machine that comes equipped with everything you need to weld . . . electrode holder, ground clamps, cables, headshield, even sample electrodes. Does all kinds of jobs besides welding . . . hardsurfacing, thawing frozen pipes, cutting metal, etc. And the newer, companion AC **Lincwelder,** the AC-225-S, does all these things and more. Why? Simply because it has a higher open-circuit voltage which lets you handle the new, fast iron-powder electrodes in sizes up to 5/16". Low cost? This machine which comes complete—just as the AC-180-S—sells for less than most competitive 180-amp machines.

LINCOLN WELDERS

Why not consider putting one or more **Lincwelders** to work in your shop today? Want more information? See your local Lincoln field engineer . . . he's a specialist in welding. Or write direct for bulletins listed on the next page.



**Lincwelder** motor-generator sets are equipped with dual continuous controls. These let the operator select the precise heat and voltage settings to suit both his style and the particular task at hand. Here, **Lincwelder** is used on typical repair job on pipe. Many of these machines purchased more than thirty years ago are still operating, still delivering top welding performance. The most elementary sort of maintenance is required . . . usually just a change of brushes is all that is needed to keep them in top running condition.

Most stainless welding electrodes require DC. Here, **Lincwelder** motor-generator delivers steady DC current on stainless-steel sink repair job. But these machines are hard to beat for any welding be it on carbon steels, alloy or stainless steels, as well as non-ferrous metals. In every instance, they assure accurate control of penetration, great arc stability and thus top-quality welds at highest possible speeds. These characteristics assure you of getting low-cost performance.

## LINCWELDERS

### Motor-Generators—DC

**Lincwelders** are noted for rugged construction combined with light weight and portability. Available in 180 and 250-amp sizes. NEMA rated at 30% duty cycle, 30 volts. Available for 60 or 50-cycle, 2 or 3-phase supplies. Operating speed is 3600 rpm. For more information, request bulletin 4101.1.

## LINCWELDERS

### Transformer—AC

**Lincwelder** transformer machines are made in two sizes, 180 and 225 amps. Both are 20% duty cycle, 30-volt machines, available for 60 or 50-cycle, single-phase power supplies. The AC-180-S is NEMA rated and meets REA requirements for limited input machines. For more information, request bulletins 4601.10 and 4610.1.

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A METAL SHOW FEATURE REPORT

**TUNGSTEN ARC** cutting is done in four easy steps. Operator sets welder, adjusts gas flow, grounds work, and gets ready to cut.

# Tungsten arc cuts stainless 97% faster

**IN BRIEF: North American Aviation used to take 10 hours to machine a hole in 8-inch stainless pipe; now tungsten arc cutting does the job in 15 minutes.**

NORTH AMERICAN AVIATION'S Rocketdyne Division in Canoga Park, California, used to machine cut and mill contoured stainless steel shapes. They use the shapes in liquid propellant rocket motors.

### PROBLEM AND SOLUTION

Rocketdyne spent as many as 10 hours machining a contoured hole in 8-inch stainless steel pipe, a typical job. Now, they do the same job in 15 minutes with tungsten arc cutting.

### CUTTING EQUIPMENT

Rocketdyne uses this equipment on stainless from ¼- to ½-inch-thick:

A standard tungsten arc welding torch with a small shielding cup.

A ⅛-inch-diameter, unpointed, 2 percent thoriated tungsten electrode.

A standard DC welder capable of supplying up to 400 amps at 60 volts, straight polarity.

A 35 hydrogen-65 argon shielding gas mixture.

### CUTTING TECHNIQUES

Leo Gilmond, welding operator, set up the cutting procedures. Throughout he aimed for adequate heat and puddling of the melted metal in the work area.

For cutting ¼-inch stainless, Rocketdyne sets the welder for 250 amps at 60 volts. Gas flow is 50-80 cfh.

They set the welder for 400 amps at 60 volts to cut ½-inch stainless. The gas flow rate stays the same.

The high amperage and voltage give the arc power for a quick bite through the stainless.

The gas mixture with a high hydrogen content boosts the arc zone temperature to 3000 F. The argon maintains a protective cover. The high flow rate of the gas mixture blows melted metal and slag away from the arc zone.

No special preparation of the work area is required. The side of the work that is to be saved is grounded. This throws melted metal and slag away from the grounded side of the cut. The resulting edge needs little finishing to get to size and remove surface porosity. • •

*EDITOR'S NOTE: Equipment designed specifically for tungsten arc cutting of stainless steel, aluminum, magnesium and copper is available commercially. This equipment includes torches and special pilot-arc circuits that facilitate starting the cutting arc. Just recently, one manufacturer announced that most of their standard tungsten arc welding torches may now also be used for tungsten arc cutting.*

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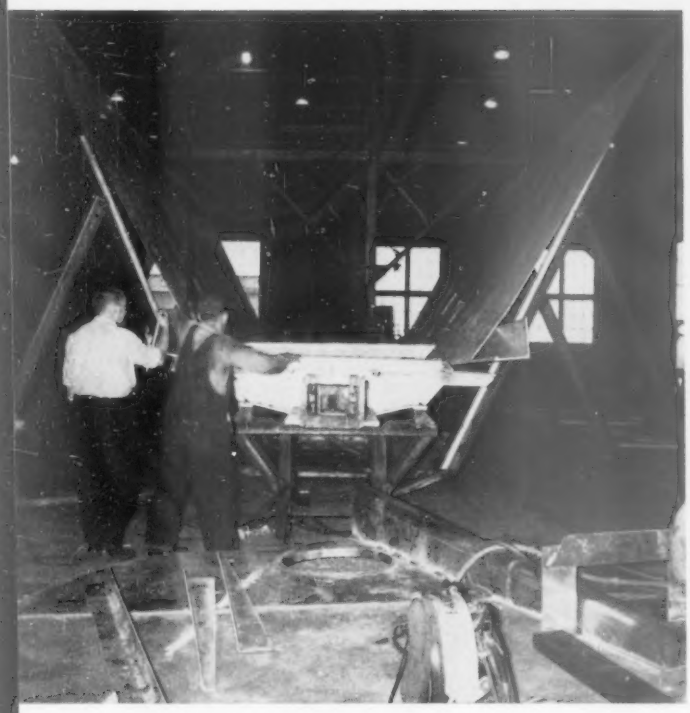


**SIDES** are positioned in assembly jig (left). Partitions and end plates are installed (top) and sides are wrapped around and tacked in place.

# Welded design makes possible

**IN BRIEF: Extrusions, high strength alloys, and welding are used to take advantage of aluminum's properties and to turn out a covered hopper car with a unique teardrop cross section.**

ALUMINUM COMPANY OF CANADA has designed an unusual, lightweight, and easy-to-fabricate covered aluminum hopper car.

Of course, Alcan is an aluminum producer and supplier, not a car builder. The new design is a bold attempt to capture a larger share of the business for aluminum. It is being offered by Alcan to customers in the United States and Canada.

## DESIGN BACKGROUND

Aluminum cars used to be built to the same basic design as steel cars. Ten years ago Alcan's engineers started an extensive design study of railway rolling stock. With the help of Canadian National Railways, they came up with the new car that has a unique teardrop cross-section.

The car uses less aluminum than previous models. The extrusions help make fabricating easier and cheaper. Copying them in steel would require more expensive equipment and would increase fabrication costs. The new design eliminates side posts and uses short stub sills in place of the conventional center sill (backbone of the car).

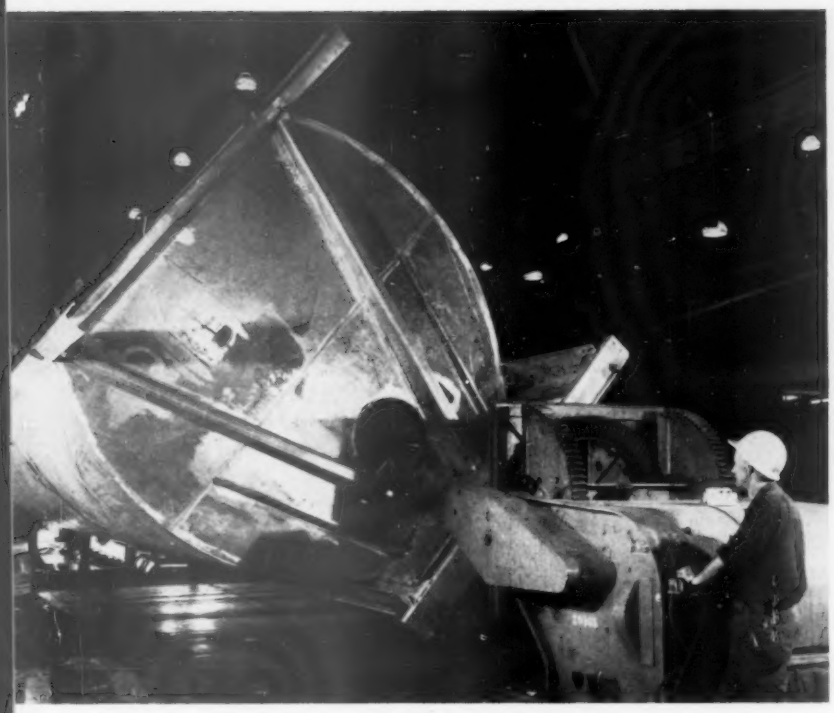
An aluminum car can carry heavier payloads than the equivalent steel car: freight car capacity is limited by the load-carrying ability of the rails. Because aluminum is lighter, a railroad could operate with fewer cars, saving money on rolling stock, wheels, axles, brakes, and maintenance.

The big reason you haven't seen more aluminum cars is that they have cost more than steel. Many customers have balked at the higher initial cost, despite projected long-term savings.

The new design reduces the amount of aluminum needed, reducing the cost differential. On the basis of cost per ton of capacity, the new aluminum cars are comparable with steel.

The teardrop hopper car has a better tare-to-payload ratio than any other, Alcan claims. This particular shape requires the least amount of metal to enclose a given volume. In addition, the curved cross-section is conducive to free flow of bulk materials.

The 70-ton nominal capacity car (88 tons actual) has a tare weight of 17 tons and a cubic capacity of 3000 cubic feet. It is 45-feet-long. It incorporates about 10,600 pounds of aluminum, of which 2,500 pounds are extrusions. Larger cars are being built.



A METAL SHOW FEATURE REPORT

by **HENRY LEFER**, *eastern editor*

**POSITIONER ROTATES** weldment for downhand finishing passes (left). Notice unique teardrop cross-section of car which permits faster unloading of alumina, adipic acid, lime, cement, sand, and salt.

# a unique aluminum hopper car

The extrusions help simplify welding. Bevel edges are designed into the extrusions so plates and sheets can be welded to them with no preparation other than wire brushing to remove dirt or scale.

Among the major extrusions is the new stub end sill, consisting of two extruded channels. In conventional construction, a center sill (similar to the keel of a boat) runs the length of the bottom of the car. This car has a stub sill about 10-feet-long at each end of the car. To each is welded a shear plate which carries the end loads to the bolster and side sills.

Eliminating most of the center sill means the car can be built with a single bottom outlet in each hopper section instead of two—one on each side of the sill—as normally required. The prototypes have six of these bottom outlets, although cars under consideration have as few as three. They can be operated from either side of the car.

Side plates, ladder posts, and various angles, reinforcements, supports, brackets, and connections are other major extrusions. The extruded alloy is Alcan 65S-T6 (equivalent to our 6061-T6). The sheet alloy is Alcan D54S (6202) in several T-conditions.

No side posts are used in this design. The curved shape gives the necessary rigidity to the sides. The individual side sheets are butt welded to each other and then welded to the beveled sides of the side sill and side plate extrusions. Eliminating the side posts and replacing the center sill have reduced welding footage and total weight considerably.

Modular construction is used. By adding 60-inch side sheets, the length of the car can be stretched in 5-foot-increments without changing the design or fabrication of the ends.

## WELDING TECHNIQUES

Welding is done with the gas shielded consumable electrode process using d.c. reverse polarity, argon shielding gas, and Alcan 56S (5056) wire. Semi-automatic and full automatic welding is used.

The car is built up from four major sub-assemblies; sides, complete with side sills and plates; stub sills, including shear plates and bolsters; partitions, and hopper outlets.

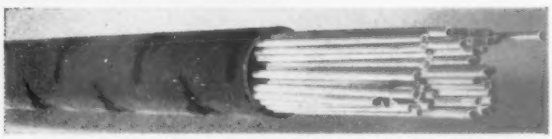
There is a total of 830 feet of automatic welding and 1855 feet of semi-automatic welding in a car. Automatic welds include joining the side sill and side plate extrusions to the ¼ inch side sheets and the side sheets to each other.

The side sheets are welded to the side sill in a single pass at 17-20 ipm. They are welded to the side-plate in a single pass at 36 ipm. Wire is 3/32-inch-diameter, fed at 205 ipm. Argon flow is 60 cfh. The

*turn the page*

# 3 METHODS OF PRODUCTION BRAZING ...Which is best for you?

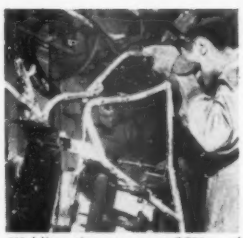
## FLUX COATED ROD



A new brazing concept—engineered flux-coated bronze—thick and thin extruded coatings to fit maintenance or production needs.

Work goes fast and even with ALL-STATE's extra thin coated bronze type alloys. Flux is extruded evenly, at thickness of only .0065, to assure excellent control and easy clean-up. Narrow beads are obtained with consistent proportion of flux to rod. Coated rods are highly efficient, require minimum amounts of rod and flux.

## BARE ROD AND FLUX



Welding time was cut 25% and clean-up time 75% by using All-State nickel-silver and separate flux when brazing 1" mild steel tubing in power saw frame production.

For the occasional job or where brazing operations change from time to time, ALL-STATE suggests that bare bronze with #41 or #1 flux is the most flexible method, providing maximum control of capillary flow. Recommended for deep joints.

Nickel-silver rod with #11 flux is a versatile combination for joining dissimilar metals. TS up to 80,000 psi.

The bare rod and flux method permits use of special fluxes for unusual applications.

## AUTOMATIC FLUXING SYSTEM

World's largest industrial stapling machine manufacturer found solution to assembly problem with high-strength All-State #11 nickel silver and automatic Jet Flux production brazing systems.

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JET FLUX dispenser, approved by Factory Mutual, is simple to fill, operate, clean, and re-fill. Can be used to feed liquid flux in exact amounts through oxy-gas or air-gas systems. Save on fuel cost by using Liquid Jet Flux with oxy-propane or natural gas stepped up to 8 lb. pressure. Send for free information on how to adapt torch for these lower costing fuels.

**ALL-STATE has quality rods and fluxes for all brazing methods. Send for folder on JET FLUX. Also free 56-page Instruction Manual and Catalog.**

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## ALUMINUM CAR

*continued from page 67*

side sheets are butt welded at 55 ipm, using 1/16 inch wire at 340 ipm feed rate.

Semi-automatic welds include fillet welding the stub sill to the ½-inch shear plate (two passes each side) and partitions to the side sheets by T-fillets (one pass each side). Welding speeds range from 18 to 24 ipm. Wire is 1/16-inch-diameter, feeding at 265 to 360 ipm. Argon flow is 50-60 cfh.

The partitions are welded in place on the car. Then the side assembly is forced into position by chain, from the bottom up. This is done over a period of 10 minutes. The operator makes tack welds as the sheet touches the partitions and the end sheets. Then the entire car is turned on a positioner for completion of the T-fillet welds, using semi-automatic downhand welding.

### RESULTS

At present, four of the new cars are in service. Canadian National Railways Co. is using two of them. Alcan's Roberval and Saguenay Railway Co. is using the other two, one for hauling alumina. The cars have also been used to carry adipic acid, lime, cement, salt, and sand.

With the curved sides and center outlets of the new design, evidence is already piling up that faster unloading is a significant advantage of this design. In one case, cement was unloaded in a fifth of the time usually required—four minutes against 20. • •


# INCREASE PRODUCTION measure actual welding performance automatically

**"WELD-RECORD"** senses the current delivered to the welding head and records the "on-off" pattern on a time printed chart roll.

**SUPPLIES AUTOMATIC MEASUREMENT** of actual welding time. Totals productive time for any period – makes possible cost analysis in terms of "CPDP".

**PROVIDES TIME STUDY DATA** by locating areas of low and high productivity. Easy access window enables operator to mark reasons for downtime on tape.

**EASY TO INSTALL ... TO USE ... TO MAINTAIN**

More detailed information available on request. Write for brochure.

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# Why you should always use **STOODY BUILD-UP** to support a **HARD-FACING OVERLAY**

Worn parts are sometimes rebuilt with mild steel followed with an overlay of hard-facing. This procedure is like trying to support a thin glass plate on a sponge. *Poor compressive strength in the supporting base causes cracking and spalling of the surface alloy.* To insure a proper base use STOODY BUILD-UP... *it does a job mild steel can't approach!*

**SEEING IS BELIEVING**—Here are three ¾" diameter test pieces of different analyses, each submitted to the same 200,000 lb. compressive load.

**No. 1 E-6010 DEPOSIT**—Under pressure it has mushroomed to almost half its original height.

**No. 2 E-7010 DEPOSIT**—Somewhat better than E-6010 but still inferior for the job.

**No. 3 STOODY BUILD-UP DEPOSIT**—Has still retained virtually all its original height; shows minimum deformation.

**STOODY BUILD-UP CHARACTERISTICS**

Besides high yield strength, STOODY BUILD-UP provides good ductility; RC hardness ranges from 21 to 34 (depending upon application procedure). Can be deposited in a higher useable current range; up to 275 amps with 3/16" electrodes. Arc is smooth and stable. Smoke and spatter loss are minimum. Beads lay smoothly and high buildups can be made in a single pass. STOODY BUILD-UP offers the highest burn-off rate in the industry—61.8 ft. per hr. Deposits up to 6.30 lbs. per hr., higher with larger electrode diameters... results in less cost per applied pound. Deposits are machinable.

## WHERE TO USE STOODY BUILD-UP

- As an underbase for hard-facing overlays
- For restoring size to any low alloy or carbon steel part
- As a final deposit to parts subject to high impact and compressive loads
- As a machinable deposit on steel shafts and slow turning gears

**COST?** Lowest in its field per pound of deposited metal—*by far the most efficient electrode for the job!*

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A METAL SHOW FEATURE REPORT

# Latest developments in welding tungsten and tantalum

by **HARRY SCHWARTZBART**, *assistant director, Metals and Ceramics Research, Armour Research Foundation of Illinois Institute of Technology, Chicago*

**IN BRIEF: Tungsten and tantalum and their alloys have been successfully welded by a variety of processes. The degree of success depends on care, attention to details, and upon material composition.**

THE REFRACTORY METALS and their alloys have been successfully welded by a variety of processes. The degree of success depends on care, attention to details, and upon material composition. Generally, tantalum and its alloys are more readily weldable than tungsten. Remember these facts when you weld these refractory metals: Atmospheric contaminants must be avoided; fit-up should be especially good for tungsten because of the dangers associated with residual stresses; recrystallization should be kept to a minimum in welding or brazing; and automatic welding will probably yield greater reproducibility than manual welding.

These processes can be used: Tungsten inert gas (Tig); consumable electrode inert gas (Mig); electron beam; resistance welding (spot, seam, flash, fiber metal); pressure welding; ultrasonic welding; and brazing.

## TUNGSTEN

Fusion welding is difficult but it has been done with Tig equipment, with and without the addition of filler metal. There has been some difficulty with porosity in the weld. This is not surprising, since all tungsten sheet is manufactured by the powder metallurgy process and molybdenum sheet, produced by the same process, is plagued with weld porosity. Laminations and sheet defects may give weld unsoundness similar to that produced by gas evolution. It has been reported that chamber pressures above atmospheric can be used to reduce gas porosity.

Tungsten sheet panels have been butt welded using electron beam equipment. Since the base metal has no room temperature ductility, the weld is not ductile either. Whereas the transition temperature of the base metal is 500-600°F, the transition temperature of the welded joint in the same slow bending is about 700°F, which is not a serious difference. The recrystallized heat-affected zone confers a loss in tensile strength on the joint at elevated temperatures. The disparity between the base metal and the joint substantially disappears above 2500°F.

Tungsten has been spot welded for demonstration purposes, both to itself and to tantalum sheet. The structure was a type of sine wave sandwich panel utilizing 0.005-inch-thick tungsten sheet for the core. This was spot welded to 0.020-inch thick face sheets, one of which was tungsten and the other tantalum. The strength of the spot welds was given as 200 lb. in 0.050-inch-thicknesses. Button pull-out was obtained.

There has been some work on brazing and braze welding of tungsten. It is easier to produce a sound joint by braze welding with 90%Ta-10%W than by simple Tig welding. This does not solve the problem of a recrystallized heat-affected zone. Increasing the remelt temperature of a brazement is a promising approach. We are studying this approach, along with several other laboratories.

Some work has gone into brazing on 85%W-15%Mo alloy with a titanium-base filler alloy. No property data are available.

## TANTALUM AND ITS ALLOYS

The story on tantalum is short because alloy development of tantalum-base alloys has barely begun. With adequate precautions unalloyed tantalum can be Tig welded and resistance welded to provide sound and ductile joints. As with other refractory metals, electrode sticking is the major difficulty in resistance welding.

Tantalum does not appear to be a problem child primarily because most sheet materials are of the highly ductile unalloyed variety. The only alloys available in sheet form contain 10-20 percent tungsten. The 90%Ta-10%W alloy can generally be welded to provide a joint with good room-temperature bend ductility.

The brazing of tantalum has received very little attention. Tantalum has been vacuum brazed to copper using the following filler alloys: Copper-tin, gold-nickel, silver-manganese, gold-copper, copper-titanium, and silver-copper-manganese. The programs presently devoted to tungsten and columbium will probably produce results which are applicable to tantalum when the need arises. • •

*EDITOR'S NOTE: This article is based on a paper presented at the Conference on High Temperature Materials held recently in Cleveland by the Metallurgical Society of AIME. Complete proceedings from the Conference are being published this year by Interscience Publishers, Inc.*

A METAL SHOW FEATURE REPORT

# $CO_2$-flux-shielded welding processes

**OPERATOR WELDS** a ¼ inch bar to a ½ inch end piece; his equipment is mounted on a self-contained, mobile welding rig.

## Flux cored process and mobile rigs speed Navy's welding

SPEED AND VERSATILITY! The U. S. Naval Weapons Plant in Washington, D. C., needs them to meet deadlines on heavy steel weldments that are needed too urgently to let out for bids.

### THE WELDING PROCESS

One way the Weapons Plant gets speed and versatility is by using the Dual Shield welding process. This is a semiautomatic process, developed by National Cylinder Gas Division of Chemetron Corp. It uses a flux-cored electrode and carbon dioxide shielding gas.

The inner core of flux deoxidizes the weld area. This deoxidizing also means that little surface preparation is needed. The flux also contains a slag-forming agent that makes it easy to remove slag. The flux-cored electrode also reduces spatter so finished welds need little cleaning. The $CO_2$ gas protects the weld area from the atmosphere.

Supervisors at the Weapons Plant say the process's operating simplicity and always-visible arc give them consistent weld quality and make it easy to train operators. The operator adjusts the voltage, current wire feed, rates, and $CO_2$ flow. Then he pulls the trigger, strikes his arc, and welds.

The Weapons Plant also says the process gives the high deposition rates characteristic of the $CO_2$ welding processes. On one job, a 219-inch-diameter cylinder (made from ¼- and ½-inch mild steel with about 60 feet of welds) welding time was cut to 1/7 what it was with coated electrodes.

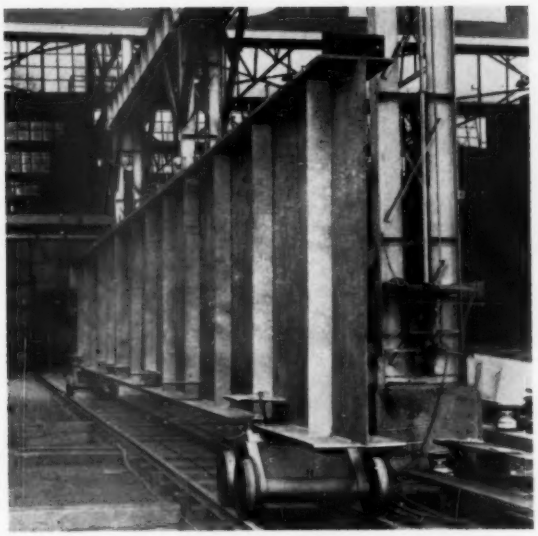
Weld quality is high, too. On several jobs X-ray inspection was waived.

### MOBILE WELDING RIGS

Another way the Weapons Plant gets speed and versatility is by mounting their semiautomatic welding equipment on self-contained, mobile welding rigs. A welding power supply, control unit, and welding gun and hoses are mounted on a dolly. The rig also carries its own supply of shielding gas and a self-contained cooling system, a radiator containing 8 quarts of coolant and a circulating pump. They add anti-freeze in winter to permit welding outdoors. They need only electrical service at the welding site. • •

***Our December issue will feature a report on new developments in semi-automatic welding***

# are fast, versatile, and economical



**AUTOMATIC EQUIPMENT** welds web stiffeners in plate girder which is blast cleaned before it is shipped.

## Magnetic flux process keeps fabricator competitive

A SWITCH to flux-and-$CO_2$-shielded welding of bridge girder stiffeners for the Bayshore Freeway, San Francisco, reduced direct costs 40 percent. The change was responsible for a total direct-labor saving of about 5 percent, because stiffener welding makes up about 12 percent of the total man-hour cost in the 2½ million linear feet of welding on the job.

Kaiser Steel Corporation, Los Angeles, changed from manual welding with E6024 electrodes to compete with prestressed and poststressed short span concrete bridges.

### WHAT WERE THE PROBLEMS?

Kaiser Steel realized that assembling of bridge girder stiffeners hadn't changed much over the years. So they looked for an economical and reliable automatic welding method. It had to meet these requirements:

- Make welds that are uniform, free of undercut, porosity, or structural discontinuities. The weld or heat-affected zone must have a maximum hardness of 175 Brinell.
- Use a rigidly-mounted torch. This is better than mechanical guiding, because of good fit-up between parts and the need for welding the full length of the stiffeners.
- Be compact so as to keep set-up time low and portable so as to speed transfer from one girder to another.

### WHAT WAS THE SOLUTION?

Kaiser decided to use a gas-shielded welding process for two reasons:

- An open-arc process permits more accurate control of the rigidly-mounted torch.
- Gas shielded processes require no flux recovery equipment.

Kaiser chose Unionarc equipment made by Linde Company, Division of Union Carbide Corp., because it gives excellent weld quality. Because of the base metal and the absence of preweld cleaning (it's not economical), Kaiser felt a gas shield alone, such as $CO_2$, would not provide welds of suitable quality. Their experience with this magnetic-flux $CO_2$-shielded process told them the deoxidizers in the flux would remove rust and mill scale. The flux also refines the weld puddle, lowers the cooling rate, and contributes to

*continued on page 74*

PROGRESSIVE
WELDER & MACHINE CO.

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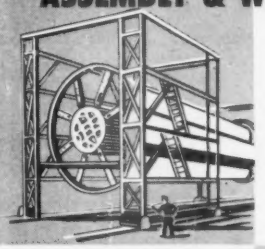

We have the facilities and ability to design and build all types of special fixtures, from mammoth space craft assembly units to tiny precision welding set-ups.

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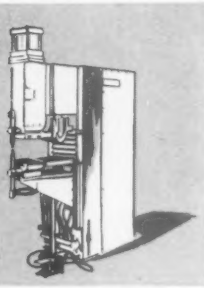
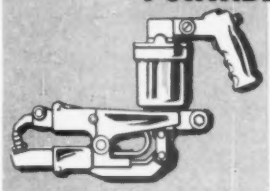


PORTABLE WELDING GUNS



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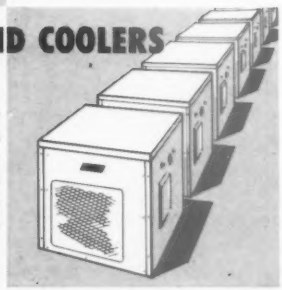

PROGRESSIVE WELDER & MACHINE CO.
915 Oakland, Pontiac, Mich.

For More Information Circle No. 88 on Reader Service Card.



*continued from page 73*

desirable weld contour. Flux and carbon dioxide gas shield the weld from contamination.

After selecting the welding process, Kaiser had to decide if they should weld both sides of the stiffener at the same time. This would require a complex and bulky welding machine. Kaiser finally chose two welding machines, one for each side of the stiffener. Kaiser designer them for quick set-up.

A simple bridge crane, running along the flanges of the girder, serves as the track for the automatic welding carriage. Flop-down locators quickly position the machine for welding. Welding torch and adjustments are shaft-mounted for fast, easy rotation into and out of place.

To get fully automatic welding, Kaiser uses a self-propelled welding carriage (with a current relay for automatic travel start and stop), plus a constant wire-feed-speed automatic control. Amperage and voltage controls are convenient to the operator. Wire-inch and retract controls operate without the wire being hot.

Each welding machine travels at 25 ipm, deposits 19 lb. of ⅛-inch-diameter wire per arc-hour at 540 amps and 31 volts.

The operating factor of 40 percent compares favorably with the old manual welding factor of 50 percent. Because of much faster welding speeds, the time-saving is 65 percent. • •

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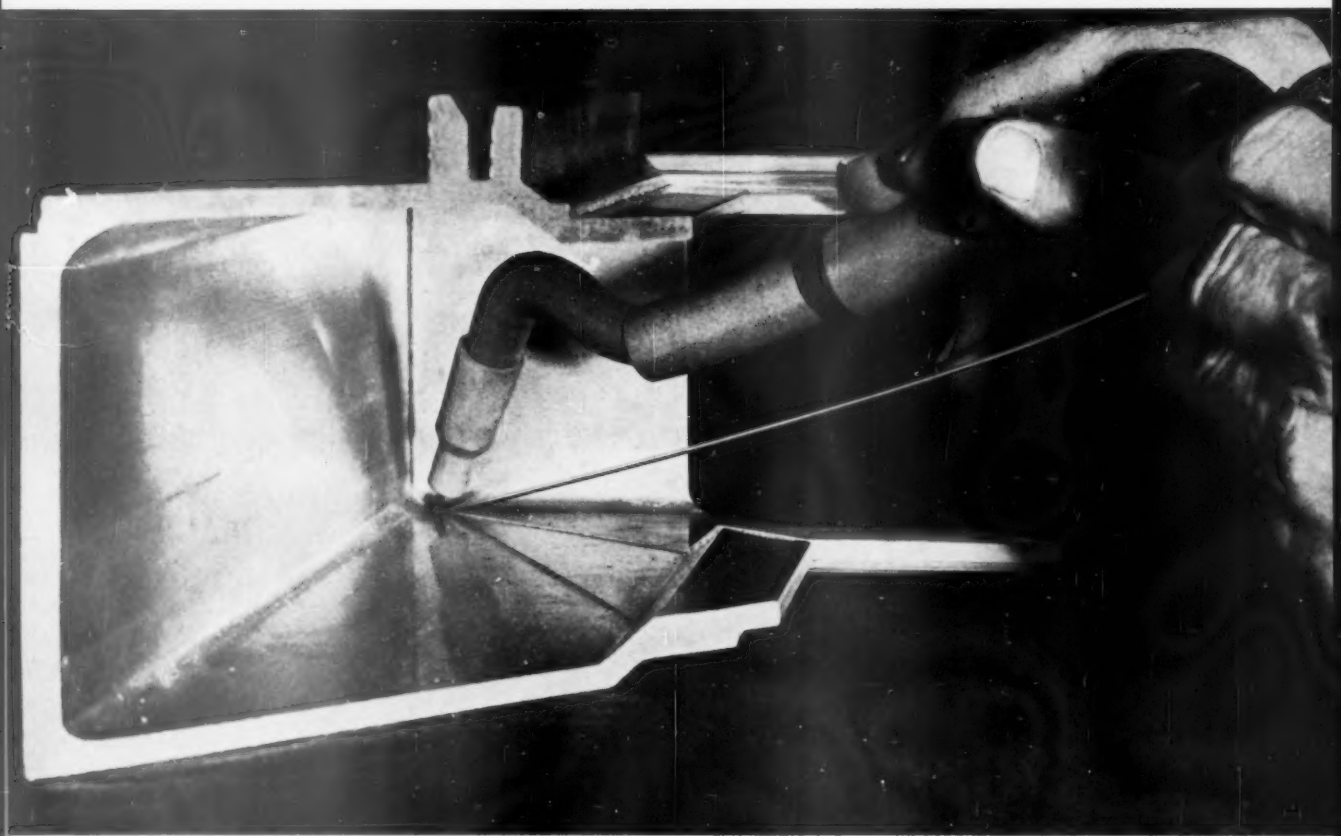
## YOU set the angle to suit the work!

## Complete flexibility is yours with the FALSTROM Controlled Angle Torch



Here is a completely NEW torch for tungsten inert gas, arc welding . . . a torch you can hand adjust to any angle or extend to reach hidden recesses. The Falstrom Controlled Angle Torch assures you of the RIGHT ANGLE FOR EVERY JOB because you set the angle to suit your preference. *No lost time* changing torches. *No awkward positioning* to make the wrong angled torch do the job. The Falstrom torch means *low inventory* and *low maintenance* and this means *low cost* to the user. One torch does it all.

Model WC-180, illustrated above, is water cooled, rated at 180 amperes continuous duty, 300 amperes intermittent duty. Three different hose lengths are available with this torch — 12½ ft., 25 ft., and 50 ft. Write or call today for your free copy of our new catalog WC-60.

**FALSTROM COMPANY** 222 FALSTROM COURT, PASSAIC, NEW JERSEY PRescott 7-0013

WC/601 A

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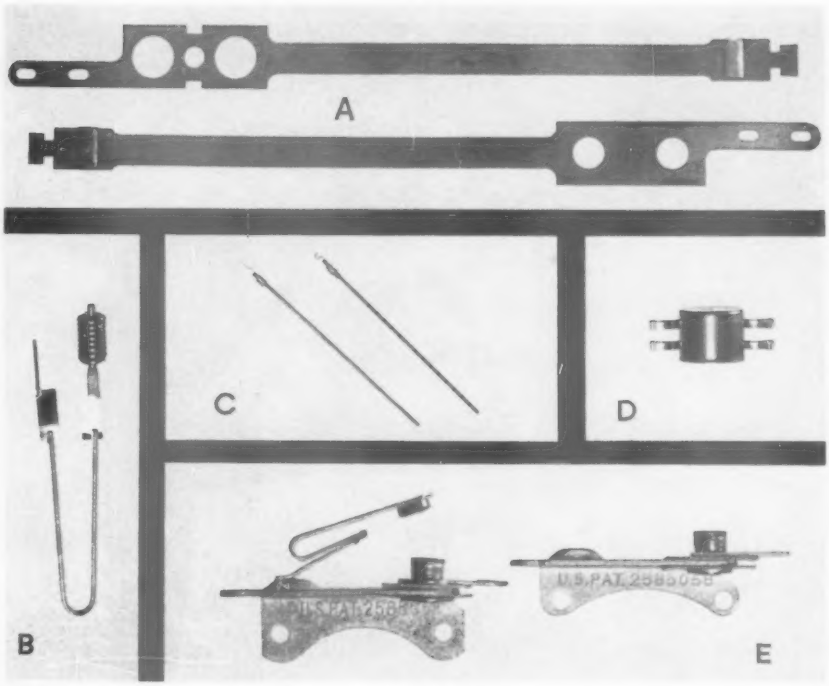
A METAL SHOW FEATURE REPORT

# Making minute parts faster




**PRECISION WELDING** is done on typical jobs like switch relay blade (A), electrode for mercury vapor lamp (B), whiskers welded to leads for glass diodes (C), grid section for cathode ray tube guns (D), and circuit breaker switch (E).

by **HENRY LEFER**
*eastern editor*

**IN BRIEF: The microminiaturization trend in the electronics industry calls for machines that can fabricate tiny parts automatically.**

IT'S LIKE WELDING something that isn't there.

I'm referring to the butt welding of copper wire to stainless wire a little thicker than a human hair. The weld is made with no upset—it has to be or the wire wouldn't serve its purpose—at the rate of 1,500 a day.

I was impressed when I watched this welding at Federal Tool & Engineering Co. For 15 years, Federal has been developing machines at Cedar Grove, N. J. to weld tiny electronic components faster and faster. As these parts get smaller and smaller, Federal keeps pace, making machines to assemble them.

The copper-steel wire I'm writing about is used in the electronic brain of IBM and Philco computers. Large numbers of 0.004-inch-diameter copper wires have to be threaded through tiny holes in glass beads. The copper isn't rigid enough for threading. It is attached to a stiff needle which has to be small enough to go through the bead.

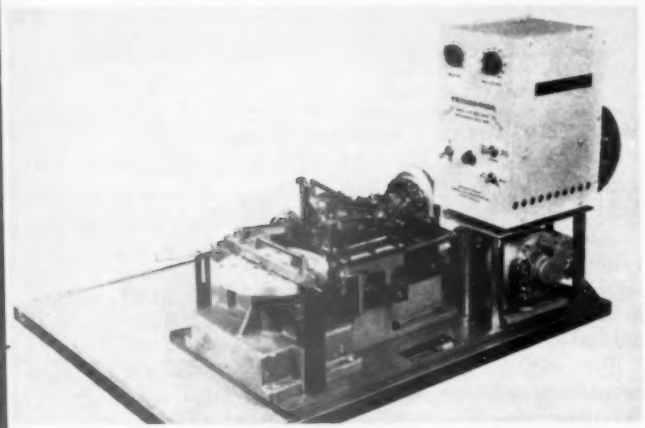
Philco used to strip the first 9 inches of each copper wire and chrome plate it. This was expensive and the chrome-plated needle had to be discarded after being used once. The 0.005-inch-diameter steel needle that's butt welded to the copper is stiffer than the chrome plated needle. It costs less and it can be cut off and reused. Welding is faster, too.

The copper and steel wires are hand-fed in a precision fixture. A microscope optical system shows the wires in two planes. When they are lined up, the operator brings them together. This completes a circuit, discharging the capacitor power supply and making a percussion weld instantaneously. Power is between 1.5 and 2 watt-seconds.

The delicate touch necessary to weld such small items with no upsetting is made possible by Federal's Tweezer-Weld principle in which precise electrode pressure is applied continuously while the metals are in the plastic state. This is for only a few milliseconds so the follow-through pressure must be instantaneous to avoid cracked or granular welds. The pressure is applied through a cam acting against

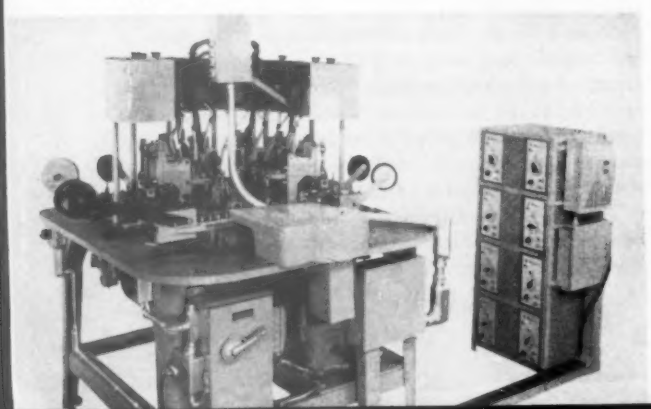
# is industry's big problem

**BUTT WELDER** joins 0.004-inch-diameter copper wire to 0.005-inch-diameter stainless needle.



**WHISKER WELDING** machine joins molybdenum, tungsten, or gold whiskers to Dumet wire leads.

**MERRY-GO-ROUND** machine makes electrodes for mercury vapor lamps.



the deflection of a cantilever spring. It can be adjusted micromatically.

### MORE PRECISION WELDING

Another extremely delicate welding job formerly done under microscopes is now done automatically at rates up to 2,000 an hour. This is welding whiskers half as thick as human hairs to leads for glass diodes (C). Developed originally for Philco, it is now practically standard for the semi-conductor industry, for attaching molybdenum, tungsten, or gold whiskers to the leads.

In this process, Dumet wire is fed off a reel, straightened, and cut to length without a burr. A glass bead is threaded on the wire, located, and sealed by heat fusion. The wire tip is cut to close tolerance and broached (shaved) on two sides to provide a clean surface. Then the whisker is fed from a reel, lap welded on the broached Dumet surface, formed into an S- or C-bend and, in the case of gold and molybdenum, cut at a 30° angle (the tungsten is too tough to cut).

The gold whiskers are 0.0015-inch-diameter; the moly and tungsten .003. Welding is done by capacitor discharge. It requires 15 watt-seconds.

### ANOTHER PRECISION WELDING MACHINE

A recent development is a machine for producing the elements, and assembling and welding them to form the electrodes for mercury vapor lamps (B). This machine was developed for Westinghouse.

The electrode assembly consists of a molybdenum hairpin section to whose legs molybdenum rectangles are welded. A tantalum lead wire is welded to the other end of one rectangle and a tungsten-wound filament to the other. It's necessary to first weld platinized moly referees at each of these attachment points to make the subsequent welds hold.

The job is done automatically on a merry-go-round machine with 8 welding stations. All the components except the tungsten filaments come on reels, as wire or ribbon, and are fed, cut to size, and welded by the machine. An operator feeds in the filaments. Production is 1600 assemblies an hour.

Westinghouse seals the assemblies in glass and then cuts the tops off the hairpins whose only function was to simplify fabrication.

### REDESIGNING FOR WELDING

To make a part suitable for automatic or semi-automatic production, Federal often suggests rede-

*continued*

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3520 W. Carroll Ave., Chicago 24, Illinois

For More Information Circle No. 78 on Reader Service Card.

**TINY PARTS** *continued from page 77*

signing it. For example, Sylvania wanted to automate the manufacture of a circuit breaker switch used in most GMC cars. The switch used round insulating washers and odd-shaped soldering plugs. Federal's redesign incorporated rectangular washers and lugs that could be fed off ribbon reels. The shape of the switch body was also changed slightly to accommodate the new components (E).

In the automated set-up, the insulator washers and materials are blanked and cut. Soldering lugs, steel washers, and contact rivets are fed from Syntrons, positioned on the body and assembled with an upset rivet. The next machine forms a two-piece bimetallic assembly and welds it. It feeds a silver contact and welds it to the bimetallic. This assembly is then welded to the body assembly.

### COMBINE FORMING WITH WELDING

A tedious forming job was automated and combined with the welding of contact for Westinghouse automatic elevator systems. The part is a switch relay blade (A). It is made from nickel silver ribbon, spring tempered.

The blade ribbon is blanked and a nickel-backed silver contact ribbon is fed across the blade, welded, and cut to the width of the blade. The blade is then formed to a predetermined opening tension, so accurately that it can be molded into the relay assembly with no hand manipulation. Production rate is 75 blades a minute. Formerly, the operator had to form each blade shape with pliers and clamps. Welding of the contacts to the blades is a.c., ½ cycle, 3½ KVA.

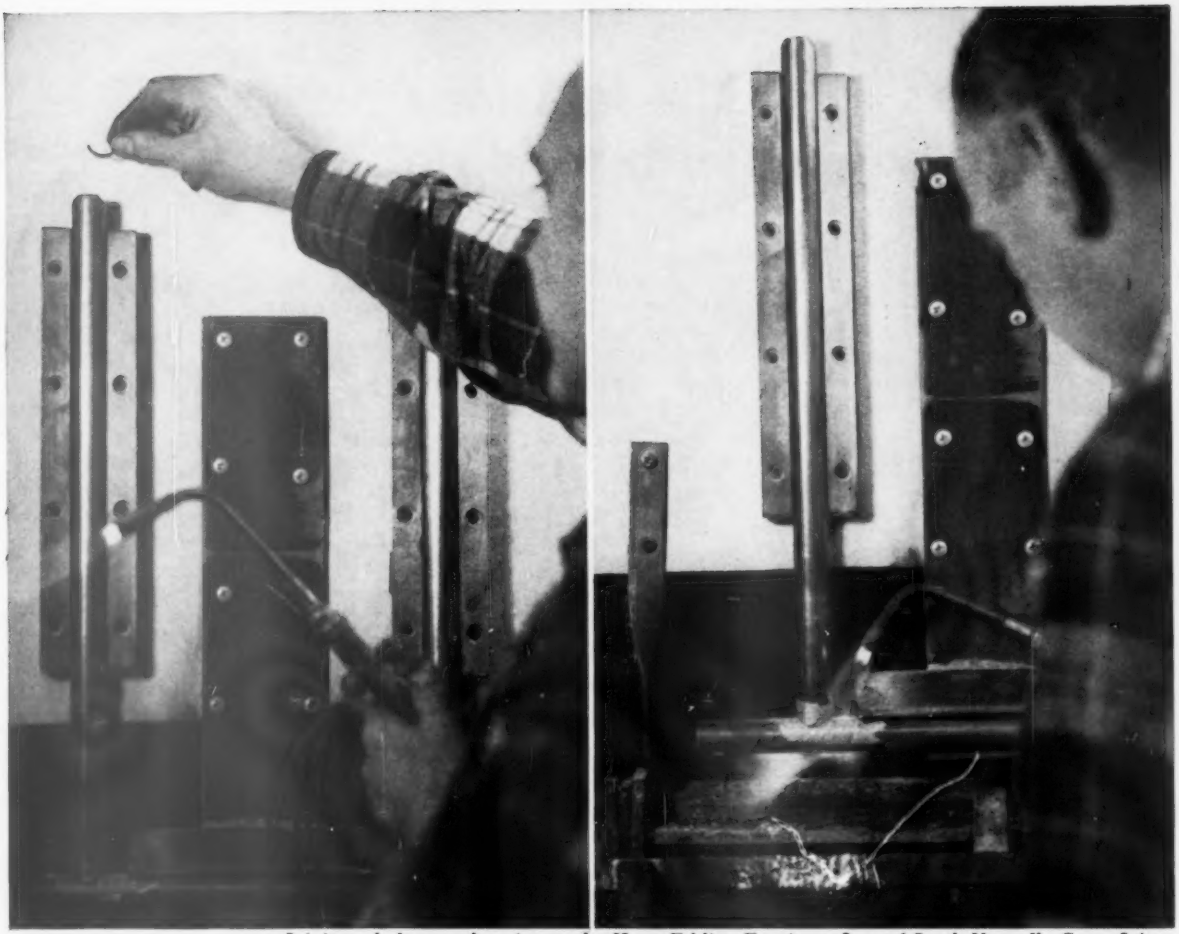
### MAKE WELDS WITHOUT HEAT DISTORTION

Federal Machines are widely used in the production of cathode ray tube guns (WELDING DESIGN & FABRICATION, September, 1959, page 44). These guns contain a number of cylindrical elements, which must be aligned precisely. By capacitor discharge welding, stainless steel studs are joined to the 18-8 or Type 305 stainless cylinders without heat distortion.

The cylinders are fed and oriented either by hand or automatically, depending on the machine, while the stud wires are being reel-fed, welded to the cylinders, cut, and a ridged flat formed at their ends. The ridged flats help anchor the elements in glass stiffener aligner rods.

Fabrication of the No. 1 grid section (D) for one type of cathode gun is an example of the low heat generated by the Tweezer-Weld system. This section has closed end, with a pinhole at its center for focusing the electron beam. Flatness of the closed end has to be maintained within 0.0003 to insure accurate focus. Welding time by the capacitor discharge method is in milliseconds, so there is no chance for the end to distort.

The studs are attached at rates up to 9,000 an hour. Power is 25 watt-seconds. Alignment of the studs is held within ½°. • •



Joining tubular members is easy for Howe Folding Furniture, Inc., of South Norwalk, Conn. Joints are fluxed with Handy Flux, a half-circle preform of EASY-FLO brazing alloy is dropped down the tube and a torch is applied. Result: A smooth, strong joint quickly and economically made.

*How Handy & Harman Brazing Alloys*

# GIVE FOLDING FURNITURE 100% JOINT RELIABILITY

The experience of Howe Folding Furniture, Inc., with silver brazing merits close attention if your operations involve metal-to-metal joining of any kind. Howe manufactures folding metal tables and seats for commercial, industrial and institutional use. You can imagine the hard usage the furniture has to take—yet survive indefinitely.

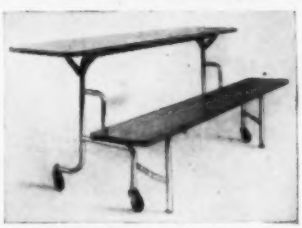
Some years ago, it was Howe's practice to purchase prefabricated steel tubular assemblies in which the joints were brass brazed on the outside surface. To improve their product, Howe thoroughly tested all joining methods, and decided to go over to silver brazing in their own plant, using Handy & Harman EASY-FLO Alloys 45 and 35. Look at the results:

**Complete Joint Reliability:** Since adopting silver brazing, Howe has completely eliminated the problem of broken joints.

**Economy:** Silver brazing costs Howe less than other methods, requires less heating time, simpler equipment, much less cleaning and grinding of joints.

**Appearance:** Silver brazing provides a smoother, more attractive joint, that can be plated directly.

Is it any wonder Howe says: "We'd stay with silver brazing even if it cost more." There are few fields of industrial activity where the strength, high production rates and economy afforded by the Handy & Harman family of silver brazing alloys cannot improve the look of the balance sheet. Interested in complete details? Just write for a copy of our Bulletin 20 — it's packed with engineering and application data.



Howe cafeteria table-bench is converted to an auditorium bench with backrest in a single motion. Silver brazed joints easily absorb strains.

**HANDY & HARMAN**
850 Third Avenue, New York 22, N.Y.
PLaza 2-3400

**For More Information Circle No. 49 on Reader Service Card.**

# Here's what the Russians are doing with welding

A METAL SHOW FEATURE REPORT

**ALUMINUM:** The static tear and shear strengths and the fatigue strength of ultrasonic spot welds on aluminum alloys (2024-soft and 5154) are equal to those of resistance spot welds, either at room temperature or at elevated temperatures. However, ultrasonic welds in static tests show a wider spread of values than resistance welds. In a vibration test the spread of values was approximately the same for both ultrasonic and resistance welds.

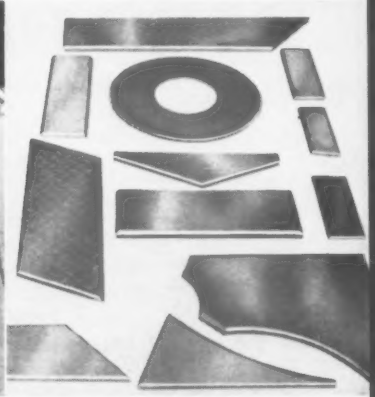
**CARBON STEEL:** Experiments on cold welding of carbon steels conducted at the Latvian Academy of Sciences showed that the degree of reduction needed to achieve a solid bond is approximately the same as that in the welding of ductile nonferrous metals. Cyaniding of the contact areas prior to cold welding promotes the bond formation by reducing the detrimental effect of surface contamination. The strength of cold welded joints is rather low. This is apparently the result of high residual stresses, since the strength increases considerably after annealing at 700°C.

**COPPER:** Studies have been made on ultrasonic welding conditions, specifically the effect of the clamping pressure, temperature, duration of exposure, and ultrasonic treatment conditions on the strength of the fused joints, as well as the microstructure and deformation of the specimens near the joints. The simultaneous action of static and dynamic pressures was found to accelerate fusion and to produce strong, airtight joints. Maximum deformation: 1 percent. Ultrasonic treatment of the heated specimens at a definite amplitude resulted in an intensive recrystallization fracturing of metal grains.

**MOLYBDENUM:** The Moscow Institute of Power Engineering conducted experiments on welding of 0.55-2 mm thick sintered and cast molybdenum. Experiments with conventional argon-shielded arc welding were unsuccessful. Then a controlled atmosphere chamber was tried. However, even then no good welds could be obtained on sintered molybdenum; the welds made with titanium foil (as deoxidizer) inserted between the faying edges


ELEVEN FEET PER MINUTE

FASTEST WAY TO BEVEL STEEL PLATE FROM ⅛" TO 2" THICKNESS



LARGE PLATES

Speeds up to 11 ft. per min. Large plates mounted on a table equipped with rollers, the Pullmax X-8 Beveler feeds the material automatically as it bevels the edge.

OR SMALL SEGMENTS

Cuts costs by 85%. Small pieces are usually very difficult and time consuming to bevel. Now, they are hand held and quickly run through the Pullmax X-8 Beveler.

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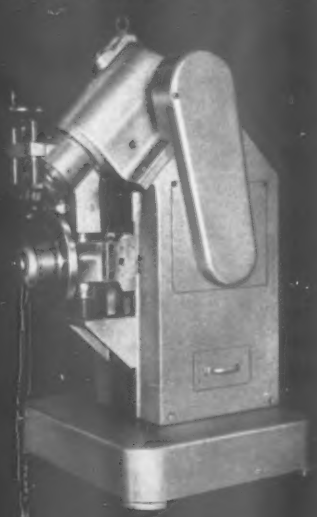
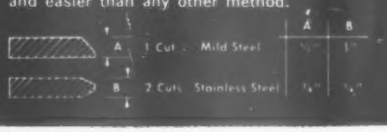
AVAILABLE 30°, 37½° and 45° BEVELS



No more slow grinding, burning or planing a bevel on steel plate before welding. Now the Pullmax X-8 Beveler does the work faster and easier than any other method.

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| 7 | 19 | 31 | 43 | 55 | 67 | 79 | 91 | 103 | 115 | 127 | 139 | 151 | 163 |
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were sound and dense, but very brittle. The cast molybdenum, when welded in the chamber in an argon atmosphere, showed much better weldability. Dense, sound welds with a clean, shiny surface were obtained without deoxidizers. The weld structure was coarse, the weld strength at room temperature about 50-56 percent that of the base metal, and the weld ductility low, 5-30° (measured as bend angle). At 100-125°C, however, the bend angle increased to 130°. Short (2-5 seconds) exposures to temperatures of 800-1000°C improved the room temperature ductility and raised the bend angle to 50-90°. A further increase of ductility with a bend angle of 140° can be achieved by grinding the weld surface to a depth of 0.5 mm. The grinding removes shallow tears.

**NICKEL:** The Electric Welding Institute has developed ceramic (unfused) flux for automatic and semiautomatic submerged arc welding of nickel. The new flux is said to insure a higher production rate and a higher weld quality than manual argon-shielded arc welding.

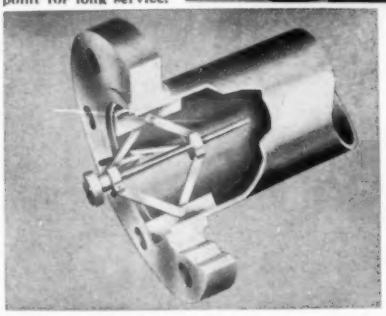
**PLASTICS:** The All-Union Scientific Research Institute has developed two experimental devices for welding plastic sheets and films for lining ferroconcrete containers. The first is a portable weld for welding sheets 3 mm thick. It consists of a turboblower and a small torch. Used with welding rods, it provides for strong, tight butt and T-joints. The second device for welding nonreinforced polyamide and polychlorovinyl films (0.7-0.8 mm thick) consists of special tongs which are electrically heated. The external heat source is of the contact type.

**STAINLESS STEEL:** A nitrogen-hydrogen mixture containing 7 percent hydrogen can be used as a backing gas in argon-shielded arc welding of stainless steel pipe. This backing has no oxidizing effect; the surface quality and the shape of the root side of the weld are the same as those obtained with argon backing. The mixture is not explosive and does not obstruct the operator's vision.

**TITANIUM:** The Scientific Research Institute of Automotive Engineering has studied the feasibility of joining small size titanium tubing (10-23 mm in diameter with 1.0-15 mm wall) and stainless steel tubing by stored energy butt welding instead of by the currently used argon-shielded arc welding. It was found that stored energy welding produces joints of uniform quality without porosity, cracks, or oxide inclusions and with a strength equal to the base metal. Another advantage is the absence of cast structure in the weld and a very narrow heat-affected zone. In the case of titanium tubing, this may eliminate the necessity of heat treatment. The method does not require pickling before welding, or shielding during welding. The permissible displacement of welded pieces is small (0-10-0.20 mm) depending on tubing diameter and wall thickness. • •

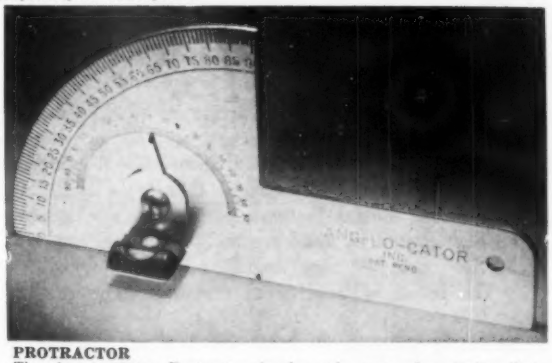

CURV-O-MARK
A CONTOUR MARKER PRODUCT

**CENTERING HEADS**
Actually, it's five tools in one—replaces protractor, centering head, center punch, level and scale. Y-Type head is accurately machined with tangents and tips to serve in centering and aligning. Dial set level is marked in 2-½ and 10 degree graduations for easy reading. Punch is of drill rod, with special point for long service.



**FLANGE ALIGNING TOOL**
This self-centering tool makes pipe line construction faster and more accurate. It is quickly adjustable for all type of flanges or pipe sizes ranging from 3 to 12 inch diameters.
After easy insertion in pipe, Flange aligning tool centers itself snugly against the inside pipe diameter and automatically aligns with pipe axis.

**RADIUS MARKER**
The Standard Radius Marker folds to pocket size. This sturdy, folding Radius Marker has a span of 24" and easily swings a 48" circle or arc.
The Jumbo Radius Marker is also the folding type, has a span of 48" and easily swings a 96" circle. These tools are precision made of rust proof aluminum dural.
The Standard Radius Marker folded, measures only 9¼" in length, weighing only 8 oz. The Jumbo model, of course, is larger. Both are equipped with special spring washers to maintain accuracy and rigidity for years of service. Pencil holder is made to hold round or flat pencils, soapstone, or steel point.




**PROTRACTOR**
The Ang-Lo-Cator Protractor is the only measuring device that quickly and accurately determines correct degree of angle on any pipe or structural material, regardless of size. A valuable aid to weldors, structural workers and pipe fitters. Size 4" x 8"

**CONTOUR SALES CORP.**
**1843 East Compton Boulevard, Compton 2, California**
**See Your Welding Supply Dealer For All Curv-O-Mark Products**

**For More Information Circle No. 36 on Reader Service Card.**

A METAL SHOW FEATURE REPORT

# Welded fabrications: Should you buy them or should you make them?

**IN BRIEF: Here are some things you should know before you decide to make your own weldments or to buy them.**

MOST COMPANIES KNOW the economies of welded fabrication. The only question for them is: Should we make our weldments or should we buy them?

The decision is not an easy one. You must investigate many factors before you can make the right choice. These factors vary from part to part, from month to month, and from company to company. And, they are complicated by things like work loads, business conditions, and geography.

However, there are three primary areas on which you can base your decision: Direct costs, indirect costs, and noncost factors.

## DIRECT COSTS

*Factors*: Development, design, engineering, labor, materials, transportation, overhead, and profit.

*Analysis*: When you buy from a fabricator, you get the use of his skilled and integrated organization. He does your design, development, and engineering—or he helps you with it. He furnishes labor, materials, transportation—usually cheaper than you can yourself.

In effect, the fabricator is your manufacturing arm, an arm that does not have the continuing costs of a captive manufacturing operation.

The result is usually less cost and more profit.

## INDIRECT COSTS

*Factors*: Heat, light, power, rent, taxes, insurance, supervisions, inspection, materials handling, bookkeeping, and expenditures for capital equipment.

*Analysis*: Sometimes these costs are eliminated or reduced when you buy instead of make.

The fact that you don't have to buy capital equipment is very important. This means you don't need expensive and sometimes specialized equipment which you cannot use constantly and to full capacity. In fact, you can even sell the equipment you now have.

And you don't have depreciation problems.

A typical fabricator has about 35 classes of tools and equipment for positioning, lifting, cutting, bending, forming, heat treating, welding, and inspecting. The fabricator can afford them because he amortizes them over many different jobs. And, he can afford skilled, full-time workers to run this equipment.

## NON-COST FACTORS

*Factors*: These are varied. They include possible changes in the best way of making parts due to technological improvements; variations in delivery requirements, alterations in the material, accuracy, or quality specifications, and the possible need for engineering assistance.

*Analysis*: The fabricator takes care of all these factors. His experience, technical competence, and creative ability are benefits that cost nothing when you buy from him. Companies specializing in welded fabrications are forced by competition to analyze their operation carefully and continuously. They can only stay in business if they are flexible enough to continue making better weldments faster and cheaper.

## A REMINDER

Price should not be the only gage to apply in making the make-or-buy decision. Consistent quality, maximum performance, and dependable delivery are equally important considerations. The reliability, integrity, experience, and facilities of the fabricators are all factors that must be carefully studied. • •

*EDITOR'S NOTE: See our February, 1961, issue for more information on welding fabricators and the creative role they are playing in the growth of the welding industry.*

# STEELWELD SHEAR WORKS 3400 HOURS A YEAR

*"Serves Art Iron, Toledo" for Over 10 Years*

**This shear provides sharp straight, accurate cuts every stroke. Here it is cutting a ¾ inch steel plate.**

All shearing at the Art Iron & Wire Works, Inc., a 200-employee plant in Toledo, Ohio, is done on a Steelweld Pivoted-Blade Shear rated for ¾" x 12'-0" mild steel. This is the only shear in the plant.

Art Iron manufactures ornamental iron and structural steel items to order and also has a large steel warehousing operation. An inventory of over 10,000 tons of steel of every kind, size and shape is maintained to serve any need. This work keeps the Steelweld busy cutting a great variety of steel items varying in thickness from 18 gauge to ¾ inch.

The Steelweld feature most valued by Art Iron is the knife-clearance adjustment. They know that to obtain the best cut with the least burr and distortion, it is essential to have the clearance set to suit the plate thickness. Because this adjustment is so easy and fast to make, their shear operators make it automatically as a part of the regular shearing routine.

Knife life is very satisfactory. This is attributed in large part to the shear operators consistently using the proper knife clearance. Despite the large tonnage of steel cut, the knives usually require regrinding only once in a period of four months or longer.

The Art Iron, Ft. Wayne, Indiana, plant also has a Steelweld Shear. Its purchase several years ago was influenced by the success with the machine in Toledo.

**Prefabricated industrial buildings are among the many items made by Art Iron. These require a large number of plates for footings, gussets, splices, etc., all of which are sheared on the Steelweld.**

*Write for free copy of catalog No. 2011*

**STEELWELD**

PIVOTED BLADE *Mechanical and Hydraulic* **SHEARS**

**Steelweld Machinery includes: Mechanical & Hydraulic Shears and Press Brakes, One-, Two- and Four-Point Straight-Side Presses, Speed-Draw Presses.**

STEELWELD MACHINERY DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 9365 E. 282 ST. • WICKLIFFE, OHIO

**For More Information Circle No. 35 on Reader Service Card.**

# 22 oz. welding torch—
# business end of a new system that can clobber your welding costs

This new straight-through torch is the lightest, coolest and most maneuverable you can buy . . . yet it can handle wire at speeds up to 1170 ipm.

It's part of a new Westinghouse system for thin gauge welding that combines the speed and economy of semi-automatic welding with the maneuverability of stick welding.

To back up the torch there's a new wire drive system with a vernier adjustment that permits exact feed control heretofore impossible. The power source for the package is the proven Westing-Arc RCV silicon welder with built-in Dynamic Reactor.

For more information see the opposite page . . .

Westinghouse

## New Westinghouse SA-200 Welding System

**Here are some of the advantages of the new Westinghouse SA-200 system:**

**22 OZ. TORCH** has an exclusive 360° rotating nozzle that permits the operator to keep the switch in the most comfortable position for any welding job. The torch is air cooled, has a 15-foot cable, handles both mild, stainless steel and aluminum wire. It can be used with $CO_2$, argon or argon gas mixtures.

**PRECISE WIRE SPEED CONTROL** obtained from a vernier type potentiometer gives you exact wire speed required—as high as 1170 ipm. Both drive rolls are powered to provide positive wire feed.

**HIGH EFFICIENCY 200 AMP RCV WELDER** provides lower power consumption than is possible with any comparable system. Controlled output characteristics of this welder, combined with precision wire speed control and a highly maneuverable torch, provides the ultimate in welding gauge size materials.

**THE WESTINGHOUSE SA-200 SYSTEM** will enable you to have *all* of the advantages of semi-automatic welding and yet retain the versatility of stick electrode welding. All this with as much a savings as 50% in your welding cost. Designed for production welding, there is a continuous feed from a 25 lb. spool of wire, no slag removal, no stub loss, and with the highest deposition efficiency.

**READY TO ADVANCE?** Call your Westinghouse distributor for a demonstration, or write Westinghouse Electric Corp., Westing-Arc Dept., P.O. Box 2025, Buffalo 5, New York.

*You can be sure . . . if it's Westinghouse.*

J-10488

**Circle No. 108 on Reader Service Card.**

# REFERENCE DATA *catalogs, handbooks, manuals*

**HARD SURFACING** electrodes and wires are featured in a 64-page catalog of individual data sheets on Alloy Rods Company's complete line. Included are Wear-Arc and Wear-Flame hard surfacing electrodes and rods and Wear-O-Matic hard surfacing wires and wire feed units. Each data sheet includes a description of the product, its application, typical physical and chemical properties of the deposited weld metal, welding and packaging data.

**Circle No. 300 on Reader Service Card.**

**PORTABLE FIRE EXTINGUISHERS,** smoke and fire detectors, and built-in carbon dioxide systems are described and illustrated in a 12-page booklet from Walker Kidde & Company, Inc. Brochure P-67 outlines which types of extinguishers are suitable for use on Class A, Class B, and Class C fires.

**Circle No. 301 on Reader Service Card.**

**ILLUSTRATED BENDER BULLETIN** from Hossfeld Mfg. Co. tells you how to make hundreds of simple, tough, or complex bends with the Universal Iron Bender. Three different models are described and illustrated and 150 standard dies are listed.

**Circle No. 302 on Reader Service Card.**

**SAFE CYLINDER CARTS** are featured in a catalog sheet issued by Smith-Byrd Company, Inc. Described and illustrated are cylinder carts whose three-wheel design provides stability and reduces danger of physical injury or property damage through accidentally dropped cylinders. Carts have two positions, one for loading and unloading and another for carrying.

**Circle No. 95 on Reader Service Card.**

**METAL CUTTING SAWS** and how they can boost your production and lower your metal cutting costs are the subject of literature from Johnson Mfg. Corp. Described and illustrated are a variety of saws, including the big, tough Model J (wet or dry) which will cut 10-inch-rounds and 18-inch flats fast and accurately.

**Circle No. 60 on Reader Service Card.**

**RESISTANCE WELDING ALLOYS** in all shapes, sizes, and forms are featured in a catalog from Hercules Welding Products Co. Described and illustrated are spot welding tips, holders, seam welding wheels, copper alloy bar stock, forgings, and castings.

**Circle No. 53 on Reader Service Card.**

**SILVER BRAZING** engineering and application is to be found in a comprehensive catalog issued by Handy & Harman. If you're interested, Bulletin 20 is for you.

**Circle No. 49 on Reader Service Card.**

**"36 IDEAS** for Tomorrow's Short-Span Bridges" is the title of a booklet available to highway bridge design engineers throughout the world. Featured in the booklet and illustrated are 36 bridge designs selected from more than 300 entries in the U. S. Steel's recent $44,000 Steel Highway Bridge Design Competition. Write for your copy from American Bridge Division, 525 William Penn Place, Pittsburgh 30, Penna.

**FACTS AT YOUR FINGERTIPS:** *If you want copies of the catalogs featured on these pages, just circle the appropriate numbers on the bound-in Reader Service Card. We'll do the rest.*

**"THE USE OF WATER COOLING** for Welding Equipment" is the title of a new pamphlet available from Bernard Welding Equipment Co. The easy-to-read pamphlet covers the use, advantages, and problems of water cooling encountered in various welding processes and deals with the use of city water, central cooling systems, and individual self-contained coolant systems.

**Circle No. 27 on Reader Service Card.**

**STEP-BY-STEP INSTRUCTIONS** for applying Galvalloy galvanizing compound are given in literature from Metalloy Products Co. Test samples are also available.

**Circle No. 303 on Reader Service Card.**

**A RUST AND CORROSION INHIBITOR** which need not be removed before welding is the subject of literature offered by Special Chemicals Corp. The literature explains how Deoxaluminite protects freshly prepared joints from rust and corrosion, why it does not have to be removed before welding, and how it acts as a deporosite to improve weld quality. Trial samples are available.

**Circle No. 304 on Reader Service Card.**

**AN AUTOMATIC PIPE WELDING** machine developed by Air Reduction Sales Co. is featured in Form ADC 927. The illustrated brochure explains how the pipe welder uses the Aircomatic $CO_2$ welding process to bring production speed to pipe welding —without the need of pipe rotation.

**Circle No. 305 on Reader Service Card.**

**DIRTY OXIDE-SCALE PROBLEM** and how to solve it is explained in Bulletin 83 from Chemclean Products Corp. The bulletin tells how Chemclean 536 removes scales and oxides from stainless and aluminum before or after welding.

**Circle No. 306 on Reader Service Card.**

**FABRICATING FACILITIES** available at Lewis Welding & Engineering Co. are described in a comprehensive booklet. It explains design, fabricating, and machining services available.

**Circle No. 64 on Reader Service Card.**

**MANUAL ON WELDING** of mild and low alloy steel is now available from McKay Company. The book contains information on specifications, characteristics, and mechanical properties of the company's mild steel and low hydrogen electrodes available for mild and low alloy steels. Included is a handy reference chart listing recommended electrodes for welding trade named steels, and ASTM carbon and low alloy steels.

**Circle No. 2 on Reader Service Card.**

**TWECOLOG NO. 13** has been published by Tweco Products, Inc., in conjunction with their silver anniversary. It shows the results of 25 years of development of putting efficient ends on welding cable, covering electrode holders, ground clamps, cable connectors, lugs, and splicers in its 12 pages.

**Circle No. 313 on Reader Service Card.**


**PROFITS are built on DEPENDABILITY**

**Improve the Quality and Appearance of your welds while you save 20% or more with *Aronson* POSITIONERS**

A large mining equipment plant has taken another step forward with the addition of an Aronson 32,000 pound Headstock and Tailstock Positioner in its structural department for the welding of shuttle bodies and frames.

With the installation of Aronson Headstock and Tailstock Positioners the car bodies can easily be rotated into position to bring seams and weld locations in a flat or downhand position. The result is a considerable saving in time, but moreover the quality and appearance of the welds are very superior to previously unpositioned work.

These machines are designed to give long dependable service . . . and profits are Built on Dependability.

ARONSON BUILDS THE MOST COMPLETE LINE OF POSITIONERS
. . . WITH CAPACITIES RANGING FROM 25 POUNDS TO 600 TONS

Universal Balance® Positioners • Bench Turntable Positioners • Gear Driven Positioners
Headstock-Tailstock Positioners • TracTred® Turning Rolls • Turntables
Fully Automatic Positioners • Geared Elevation Positioners • Magnetic Welding Clamps

Quality PRODUCTS by *Aronson* MACHINE COMPANY, INC.
*Write for detailed engineering data*
ARCADE, NEW YORK

**For More Information Circle No. 22 on Reader Service Card.**

**SIMPLE PENCIL LINE SKETCHES** of intricate shapes and forms can now be used to guide oxygen shape-cutting machines with an electronic tracer developed by Linde Company, Division of Union Carbide Corp. Bulletin Form 55,043 describes and illustrates the tracer and its operation.

**Circle No. 308 on Reader Service Card.**

**LAYOUT TOOLS** for use on pipe and other weldments are featured in literature from Contour Sales Corp. Described and illustrated are centering heads, flange aligning tools, radius markers, and protractors.

**Circle No. 36 on Reader Service Card.**

**ACTUAL WELDING** performance is measured by a recording device described in literature from the Weld-Record Corp. The recorder is connected to the welding machine to be monitored and records actual duty cycle of arc welding on a time printed chart roll. Accessories featured include a time delay and a totalizer.

**Circle No. 106 on Reader Service Card.**

**STEELWELD SHEARS** made by Cleveland Crane & Engineering Co. are described and illustrated in Catalog No. 2011. Operating details and specifications are given for mechanical- and hydraulic-types.

**Circle No. 35 on Reader Service Card.**

**WELDING AND BRAZING FLUXES** that give better, cleaner, stronger joints in all metals are featured in a brochure from Anti-Borax Compound Co., Inc. Fluxes include those for cast iron, aluminum, stainless, and magnesium.

**Circle No. 20 on Reader Service Card.**

**PROGRAMMED STRESS RELIEVING** is the subject of Folder DM-157 issued by Hobart Brothers Co. The folder describes a 400-cycle induction heating unit and tells how it simplifies the preheating and stress relieving of arc welded pipe joints. Automatic operation by means of a strip chart program controller is described and illustrated.

**Circle No. 309 on Reader Service Card.**


# How flame spraying can pay for itself in your shop in a very short time

**ONE EXAMPLE**
**Hard facing time cut from 4 hours to 25 minutes**

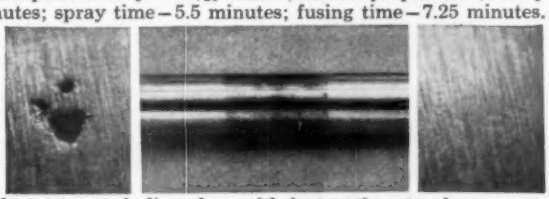
unretouched photo

**The two end sections of this shaft have been built up with AMS 4775. Section at left applied by welding – time 4 hours; section at right by flame spraying – time 24 minutes, 45 seconds.**

**QUESTION: Look at the picture. Which end would you prefer to grind finish?**

Here's the whole story. We took a 15" length of 2.5" mild steel shafting and undercut two 5" sections .050" on the radius. We then sent the shaft to a nationally-known job shop with instructions to apply AMS 4775 on the left-hand section, sufficient to finish at 2.5". Weight of welded-on alloy was 17 9/16 ounces – time spent by one of their top men – 4 hours (including preparation).

Then we blasted the second section with steel grit and flame sprayed it with AMS 4775 in powder form (ThermoSpray Powder 15E). The coating was then torch-fused. Weight of deposited alloy – 11 9/16 ounces; surface preparation, set-up and pre-heat – 12 minutes; spray time – 5.5 minutes; fusing time – 7.25 minutes.



**Unretouched photo, in center, shows finish-ground shaft. Insets, magnified about 50X, show pits in welded section (left) and no pits in flame sprayed section at right.**

We then sent the shaft out to a grinding shop with instructions to clean up at 2.500" plus. The flame-sprayed section cleaned up at 2.510" but welded section still showed pits when grinding was stopped at 2.477" Rockwell of welded end Rc-61, sprayed end Rc-60.

**Pump plunger being flame sprayed with METCO ThermoSpray® Powder Gun**

These flame-sprayed coatings are solid, homogeneous; usually superior to those applied by other methods. You can apply them at high speed, with lower material and finishing costs. In addition to AMS 4775, a number of other powders – including tungsten carbides – are available for various service requirements; all may be fused–some used as sprayed for certain service requirements.

**For further information on this high-speed, money-saving, hard-facing process, phone, write or wire.**

METCO INC.
FORMERLY METALLIZING ENGINEERING CO., INC.
® *Flame Spray Equipment and Supplies*

1179 Prospect Ave., Westbury, L. I., N.Y. Telephone: Edgewood 4-1300 Cable: METCO
In Great Britain: METCO., Ltd., Chobham-near-Woking, England

**FREE BULLETIN**

**FREE BULLETIN:** Send off the coupon for this and other useful information which shows how flame spraying pays for itself—in a very short time. No obligation, of course.

**METCO INC.**
**1179 Prospect Ave., Westbury, L. I., New York**

Please send me information on hard-facing by flame spraying.

Name _____

Title _____

Company _____

Address _____

City _____ Zone _____ State _____

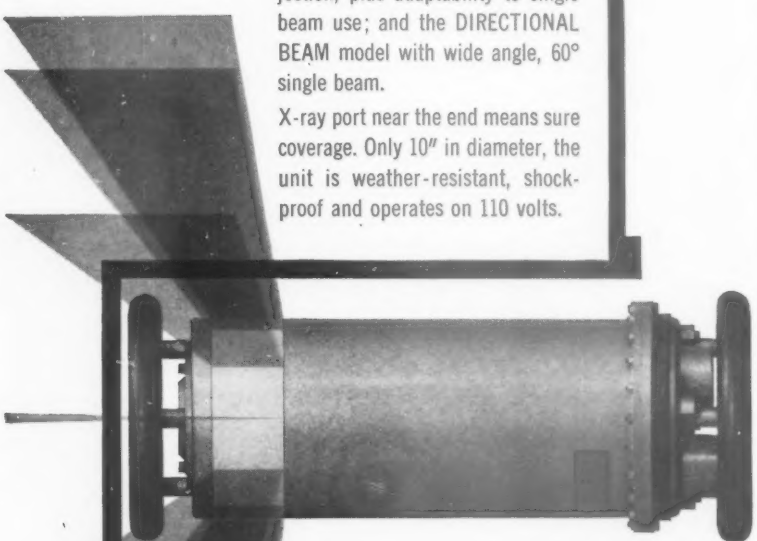
**For More Information Circle No. 79 on Reader Service Card.**

## PANORAM-X

"It will fit into places and do things others can't." This is an operator's comment about the new, low-cost Westinghouse Baltospot 150 industrial x-ray unit. It penetrates 1⅝" of steel.

One man can easily operate either 55-pound model: the PANORAM-X (pictured) permits 360° radiography with 20° forward-throw beam projection, plus adaptability to single beam use; and the DIRECTIONAL BEAM model with wide angle, 60° single beam.

X-ray port near the end means sure coverage. Only 10" in diameter, the unit is weather-resistant, shockproof and operates on 110 volts.



For more information: Westinghouse X-Ray Department, 2519 Wilkens Avenue, Baltimore 3, Md. You can be sure . . . if it's

Westinghouse

J-08394

For More Information Circle No. 107 on Reader Service Card.


USEFUL LITERATURE *continued*

**COMPLETE LINE** of torches for inert gas shielded welding is featured in literature from American Electric & Machine Co. Described and illustrated are both water-cooled and air-cooled torches. Specifications are given.

**Circle No. 14 on Reader Service Card.**

**SINGLE-SOURCE-SERVICE** available at R. C. Mahon Co. is discussed in Steel-Weld literature which explains how the company's facilities, capacity, and experience insure quality welded fabrications.

**Circle No. 72 on Reader Service Card.**

**ELECTRODE OVENS** and how they can be used to keep welding electrodes from picking up excessive moisture is explained in a booklet from Phoenix Products, Inc. Described and illustrated is the company's line of ovens, including stationary models (350 and 1100 lbs. capacity) and a portable model 10 lb. capacity).

**Circle No. 87 on Reader Service Card.**

**CHIPPING HAMMERS** with swing balance are described and illustrated in literature from Chicago Manufacturing & Distributing Co. Featured are Type A (20-ounce, drift and right angle chisel) and Type C (14 ounce, drift and chisel).

**Circle No. 33 on Reader Service Card.**

**BACKING RINGS** for pipe welding are featured in a bulletin from Robvon Backing Ring Co. Shown are Types C, CC, and CCC backing rings that are available in carbon steel, wrought iron, chrome alloys, stainless, and aluminum.

**Circle No. 90 on Reader Service Card.**

**FREE SAMPLE** of galvanizing compound is available from Galv-Weld Products. Instructions accompanying the sample explain how to use Galv-Weld alloy to regalvanize areas burned away by welding, skipped in hot dip galvanizing, or abraded in fabrication.

**Circle No. 45 on Reader Service Card.**

**REINFORCED DEPRESSED CENTER** wheels for right-angle portable grinders are the subjects of a catalog sheet issued by Brunmar Commercial Corp. Sizes, speeds, compositions, and special features of Ipaflex wheels are given.

**Circle No. 29 on Reader Service Card.**

**PROTECTIVE EQUIPMENT** for the welding operator's head, face, and eyes can be found in Glendale Optical Company's 1961 catalog. Full details and specifications are given for spectacles and lenses, face shield, welding and chipping goggles, flash spectacles, and welding plates and lenses.

**Circle No. 310 on Reader Service Card.**

**HOW ONE AMMETER** measures both AC and DC current is explained in Catalog IW-400 from Columbia Electric Mfg. Co. Described is the company's tong-test ammeter that has interchangeable ranges up to 1,000 amperes.

**Circle No. 311 on Reader Service Card.**

**FACILITIES AND SKILLS** for making quality welded fabrications are discussed in a free descriptive brochure from Steel Fabricators Company.

**Circle No. 96 on Reader Service Card.**

**RECOMMENDATIONS** for controlled cooling of Colmonoy hardsurfacing overlays when applied to 400 Series martensitic stainless steels are outlined in Technical Data Sheet T-4 issued by Wall Colmonoy Corp. The Data Sheet explains how this controlled cooling prevents cracking of the overlay.

**Circle No. 312 on Reader Service Card.**

**CAPACITOR DISCHARGE** system of stud welding is explained in a brochure issued by KSM Products, Inc. Typical applications are given for the system, along with an explanation of how it permits applying fasteners to thinnest gages of ferrous and non ferrous metals with no fillets, heat mark, burn-through, or distortion.

**Circle No. 307 on Reader Service Card.**


*By the Manufacturers of Famous*

**ATLAS** WIDE-BLADE **TOMAHAWKS**

WORLDS LEADING WELD CLEANING TOOLS

**4 NEW ACCESSORIES**

*To Make The Welder's Job Easier!*

**FAST DRAW "SAFETY" HOLSTERS**

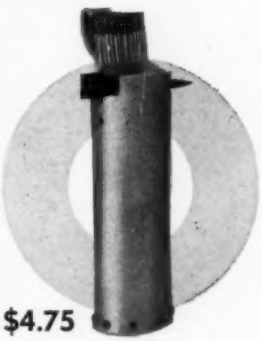
**MODEL 19 HOLDS ANY KIND OF HAMMER**

**$1.95**

Holster made of heavy full grain saddle leather with belt loop adjustable to 5 lengths. For welders, plumbers, carpenters, millwrights.

**MODEL 192 DUAL CASE HOLDS TOMAHAWK & 10 LBS. WELDING RODS**

A supply of rods and the Atlas Tomahawk of your choice at your side where you can grab them without even looking. This case has a flat bottom and will stand if you choose not to wear it while working. Heavy full grain saddle leather.



**$4.75**

**MODEL 21 FOR CARRYING ANY COMBINATION WELD CLEANING TOOL**

**$3.25**

Holds Atlas "Dual Tool" or any chipper-brush tool. Protects the welder's fingers and clothing. Prevents brush getting frayed. 5 adjustments on belt loop. Heavy full grain saddle leather.

**MODEL 15 SAFETY BELT**

Heavy webbing with rust proof ring and snap. Wear it over your coveralls as a belt or shoulder strap to carry equipment.

**$2.25**

*Tough as they come!*

*Atlas makes 33 different weld cleaning tools. There's one for every purpose and preference—Ask your welding supply dealer to show them to you.*

**ATLAS**
**WELDING ACCESSORIES INCORPORATED**
707 E. LEWISTON
FERNDALE 20, MICH.

**For More Information Circle No. 23 on Reader Service Card.**

# FOLLOW THE LEADERS...

# cam-lok

## for fast, positive POWER CONNECTIONS

See for yourself why the leading welding equipment manufacturers specify CAM-LOK Connectors, Receptacles and Plugs on many of their products. Write for complete line catalog, or detail your special requirements.

*Visit our booth #1055 at the Metal Show, Detroit, October 23-27.*

cam-lok DIVISION

**EMPIRE PRODUCTS, INC., 9213D Blue Ash Rd., CINCINNATI 42, OHIO**

**For More Information Circle No. 30 on Reader Service Card.**


**USEFUL LITERATURE** *continued*

**INNERSHIELD WELDING** is described in Bulletin No. 5300.1 from Lincoln Electric Co. Typical process applications, performance characteristics, and process speeds are given for the new semi-automatic "Innershield Squirt" and full automatic "Innershield" welders.

**Circle No. 314 on Reader Service Card.**

**HOW WELDMENTS** made by Morgan Engineering Co. can solve problems for you is explained in literature available. Facilities, experience, and craftsmanship are discussed.

**Circle No. 82 on Reader Service Card.**

**HARDENING OF STEEL** tools and parts is explained in literature from Hard-N-Tuff Corp. Described are the four steps needed to harden low carbon steels. Included are hardening temperature ranges and heat color descriptions of different grades of steel.

**Circle No. 315 on Reader Service Card.**

**VERSATILE FLAME CUTTER** from Switzerland, the Gloor Expeditor, offers many important advantages, particularly for single parts and limited production. It is described and illustrated in a catalog issued by Earth Equipment Corp. Features described include quick and accurate duplication of sketches and blueprints, exclusive guiding methods, and automatic controls.

**Circle No. 37 on Reader Service Card.**

**CONSULTING SERVICE** is offered by the John Van Range Co. This welding fabricator will look over your blueprints and tell you whether you should make your product or have a welding fabricator do it.

**Circle No. 103 on Reader Service Card.**

**"PRODUCING STAINLESS** Steels . . . Exclusively" is the title of a 12-page, illustrated bulletin available from G. O. Carlson, Inc. Printed in three colors, this bulletin describes how Carlson provides specialized services in manufacturing stainless steel plate and related stainless steel

products. Basic production limits are given for plates, heads, forgings, rings, circles, and flanges.

**Circle No. 316 on Reader Service Card.**

**FILTER PLATES** which are optically ground and polished to give unimpaired visions are the subject of literature from Thermacote Company. Featured is the company's Thermo filter plate which comes in restful soft green shade to reduce eye strain.

**Circle No. 100 on Reader Service Card.**

**FACILITIES AND SKILLS** for making quality welded fabrications are discussed in a free descriptive brochure offered by Erie Strayer Company.

**Circle No. 41 on Reader Service Card.**

**DIP BRAZING,** the aluminum fabrication technique for items used in aero-space, electronics, and commercial fields, is the subject of an 8-page illustrated technical brochure by Precision Dipbraze, Inc. The publication covers advantages, material selection, and design requirements for dip brazing.

**Circle No. 317 on Reader Service Card.**

**TACK WELDING** with d.c. power from a multi-arc system is described in a data sheet from J. B. Nottingham & Co., Inc. Data sheet describes the Weldline welding resistor, portable single-operator-model, rated 90 or 130 amps, and six drawer units for 110, 135, 150, or 180 amps. Use with other arc processes and higher welding currents are also explained.

**Circle No. 318 on Reader Service Card.**

**FORTY-TWO** of its Ampcoloy specification bronzes plus heat treated variations are described in bulletin G-61 published by Ampco Metal, Inc. This 12-page, illustrated bulletin lists nominal chemical and average physical properties, available forms, specifications, and some typical applications. Brief discriptions of Ampco's facilities and equipment are also included.

**Circle No. 319 on Reader Service Card.**

**...Low Glare & Low Fuming Characteristics Assure Operator Comfort & Quality Results**

**GB 88 Flux** is recommended for silver brazing steel, brass, copper, stainless steel, monel, inconel, chrome alloys, silver and gold. It is known throughout the industry as the "Production" flux . . . proved and dependable. Because operators recognize an improvement in the quality of their silver brazing jobs when they use GB 88. And they like its glare and low fuming characteristics.

GB 88 Flux is stable in use as well as in storage. It is fully active to 1650°F. Order GB 88 Flux in the size container that suits your needs.

For best results team up GB 88 Flux with GB Silver Brazing Alloys in the shape and size your jobs call for: random coils in all diameters, strips, straight lengths, pre-formed rings and special shapes.

Write for details. A FREE working sample of GB 88 Flux will be supplied promptly on request.

*Goldsmith Bros.*
**DIVISION OF NATIONAL LEAD CO.**

900 WEST 18th STREET • CHICAGO 8, ILLINOIS

**For More Information Circle No. 46 on Reader Service Card.**

WELD WITH
Tipaloy

YOUR Resistance Welding Electrode NEEDS Are OUR Business!

Whether it be:
TIPS:
ROD or BAR:
SEAM WELDING WHEELS:
FORGINGS:
CASTINGS:
HOLDERS:
ADAPTERS:

SPECIAL WELDING DIES or FIXTURES: TIPALOY *has them.*

BUY TIPALOY and save money!

TIPALOY can supply you with:
RWMA Class #1, Tipaloy #100
RWMA Class #2, Tipaloy #130*
RWMA Class #3, Tipaloy #200
and other RWMA classes of alloys to fit your needs.

It is unwise to pay too much, but it is worse to pay too little!

Use TIPALOY and get 30% to 100% more performance for your money than you are now getting.

BUY TIPALOY and get TIPALOY QUALITY

Send your trial order today

*TIPALOY #130 cast and processed under our patents.

FREE: Write for your copy of Tipaloy's comprehensive new catalog.

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Tipaloy INC
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DETROIT 11, MICHIGAN

Circle No. 102 on Reader Service Card.

# NEW PRODUCTS

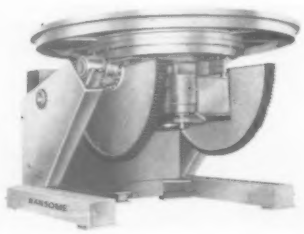
## New Concept in Welding Thin Metals

A unique concept in welding thin gage metals with speed and versatility at low cost has been announced by Westinghouse Electric Corporation. Called the Westing-Arc SA-200 system, the new welding package includes a 200 amp silicon diode rectifier power source, a compact wire drive system with wide feed range, and a new concept in straight-through torches. The power source, a Westing-Arc Type RCV welder, has features that suit it for fine electrode wire production welding of thinner gage metals.

The new wire drive system has a range of 90 to 424 ipm with standard gearing, and can be modified to provide speeds up to 1170 ipm. Both drive rolls operate to provide more positive drive feed. A micrometer assures wire feed control adjustments heretofore impossible. The torch weighs 22 ounces, and will accommodate wire sizes in mild steel or stainless from .025 inch to .047 inch. Rated 100% duty cycle at 200 amps.

Included are a 15-foot welding cable, gas hose, and electric control cable. The wire drive system and straight-through torch can each be purchased separately and present equipment modified to make use of the new developments.

**Circle No. 108 on Reader Service Card.**



## 80,000-Pound Positioner

A new, precision-designed positioner rated 80,000 pounds at 20 inch center of gravity, has been announced by the Ransome Company. The new unit features 36-inch vertical adjustment, with no column projection above the table top, even with the table in a horizontal position. A 20 hp electronic variable speed drive operating in conjunction with two electrically shifting transmissions offers rotation from a minimum of 2 ipm at 12-foot diameter to a maximum of 100 imp at 16-inch diameter. Top plate is 3 inches thick, 2 feet in diameter, machined flat to 1/64 inch with scribe marks every 12 feet of diameter. Table has a 9-inch hollow spindle easily accessible from underside. Tilt mechanism is powered by a 15 hp brake motor, through a self locking speed reducer and double tilt segments and pinions. Tilt range is 135° forward from the horizontal.

Standard accessories include generator type tachometer, remote speed control, and tilt protractor.

**Circle No. 200 on Reader Service Card.**

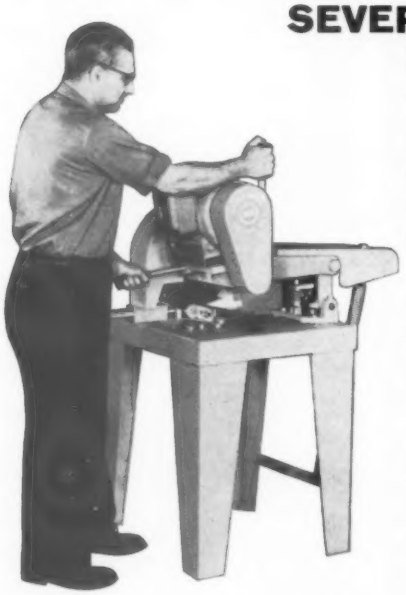
## Cold Galvanizing

The zinc-rich paint used in the Galvicon cold galvanizing process, now contains 97% zinc instead 95% according to the Galvicon Corporation. The paint gives mechanical and chemical protection to iron and steel, combines with the base metal. It can be applied by brush, spray, or dip methods right over rust.

**Circle No. 201 on Reader Service Card.**

# 12 seconds per cut on this 2-inch steel bar!

## SEVER-ALL MODEL 1-A gives high-quality cuts at low cost



Even the newest super alloys can be cut at 3 to 6 seconds per square inch on the Sever-All Model 1-A dry abrasive cutting machine. The burn-free slices of hardened steel shown above are typical of the cuts you'll get on almost any metal. *You get this speed and quality for an investment of approximately $500!*

You get big capacity, too, with the Model 1-A—up to 2″ square solids, 3½″ O.D. pipe and tubing, 3″ angle iron and 4″ channels. You can cut practically any metal. On top of that, wheel oscillation—an "exclusive" in this price range—provides cooler cutting, longer wheel life.

The Model 1-A is so easy to use, too. Wheel selection is simple—just two types of wheels do *all* your Sever-All cutting jobs. Minimum set-up time required.

You can get immediate delivery from your Sever-All distributor. ***Write*** us for his name — or ask for **Bulletin DH-106** for details on the Sever-All Model 1-A.

**SEVER-ALL ABRASIVE CUTTING MACHINES**

ACCO

**Allison-Campbell Division • American Chain & Cable Company, Inc.**

925 Connecticut Avenue, Bridgeport 2, Conn.

**For More Information Circle No. 11 on Reader Service Card.**

For More Information Circle No. 33 on Reader Service Card.

THE CMD®
chipping hammer
WITH
SWING BALANCE

This is the hammer with the balanced feel—swings easy, fits the hand properly, absorbs shock. *Less fatigue* and it's a pleasure to use!

CMD heads are made of ¾" square tool steel. They can be re-sharpened right down to the shaft!

Type A 20 oz., drift and right angle chisel.
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TYPE A TYPE C

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perform the toughest jobs with SPEED, ACCURACY, SAFETY. Equipped with 2HP heavy duty motor, the 7" model runs at 8,000 RPM, the 9" model at 6,600 RPM increasing operational performance over conventional electric and air-powered angle grinders.

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**are approved for 8,000 RPM on 7" wheels and 6,600 RPM on 9" wheels.**

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ABRASIVE SALES DIVISION
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PHONE Walker 5-3317

For More Information Circle No. 29 on Reader Service Card.



## Spatterproofing Compound

A new water-soluble and ready-mixed spatterproofing compound applied with brush prior to welding to prevent spatter from adhering has been developed by Cleanweld Product Co. Contains no oils, varnishes or other volatile substances. It is non-toxic; will not burn, smoke, or flake. Causes no fumes or odor. After welding, spatter wipes clean with dry cloth. Surface is ready immediately for painting.

**Circle No. 202 on Reader Service Card.**

## Full Circle X-Ray

A portable industrial x-ray unit that can project a full circle x-ray beam in front of itself has been introduced by Picker X-Ray Corporation. The Picker-Andrex 160-KV machine's "forward throw" feature makes it possible to radiograph such places as an entire girth weld in the closed end of a tank. A beam shaping belt makes possible the change from forward throw to directional radiography without loss of field size. The directional beam covers a 14- x 17-inch area in a 40° cone at a distance of only 30 inches. Rated at 5 MA at 160 KV, the unit can penetrate up to 2 inches of steel or 5 inches of aluminum.

**Circle No. 203 on Reader Service Card.**

## Mitre Clamp

A versatile new mitre clamp having a wide range of applications has been introduced by Abernathy Vise and Tool Co. Jaws are designed to securely hold flat, round, angular, or contoured stock. Removal of the pivot

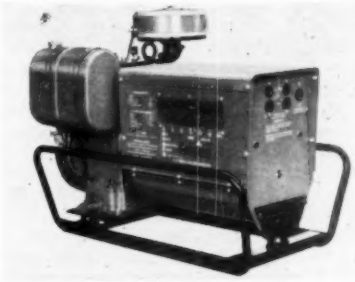
bolt permits using the clamp as two separate clamps. Opening the tool to 180° adapts it for making butt joints, overlaps, or splices. Singly or together, the Mitre-Master can also be used as a drill press vise or for machine set ups.

**Circle No. 204 on Reader Service Card.**

## 5-in-1 Headgear

A new, low-cost, all-purpose combination of standard head and eye protection units which snap onto a single special headgear has been introduced by the Dockson Corporation. The complete set of shields consists of an 8-by 17-inch unbound, plastic window; 6 or 8 inch brass screen window; 4, 6, or 8 inch bound plastic window; standard chiporweld eye shield (usable over prescription glasses); and a seamless, molded fiber welding-front with special rubber lens holder.

**Circle No. 205 on Reader Service Card.**



## Welder/Power Plant

The Memco Bantam—a smaller version of their popular AEA-200-L gasoline engine driven welder/power plant—has been introduced by Miller Electric Mfg. Co. The Memco Bantam's 12.3 hp single cylinder Kohler air-cooled engine drives a rotating field generator to produce 180 amps of a. c. welding power on a 100 percent duty cycle; 3.5 KW of 5 volt 60—cycle single-phase power; 1 KW of 115 volt d.c. power while welding. The Memco Bantam is light weight and economical.

**Circle No. 206 on Reader Service Card.**


**Circle No. 13 on Reader Service Card.**

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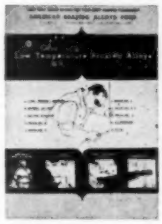
*ALUMINUM WELDING WIRE*



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Immediately available in five high capacity models to meet any metal cutting requirement—efficiently and economically.

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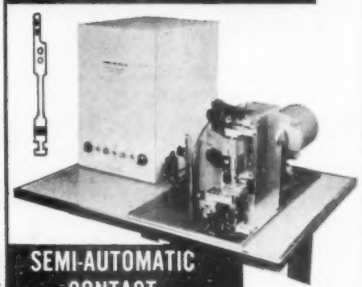
TWEEZER WELD
SMALL PARTS BY THE MILLIONS

Special Purpose Welding Machines
- SEMI-CONDUCTOR EQUIPMENT
- BUTT WELDERS
- CONTACT WELDERS
- ASSEMBLY MACHINES



SEMI-AUTOMATIC CONTACT WELDING MACHINE

. . . which feeds, welds and cuts off contact material automatically — all in one operation. Tweezer Weld has complete design facilities for special purpose welding equipment, and facilities available for producing parts for your special needs on a production basis at our plant.

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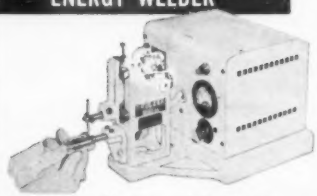

- TW5 low friction welding head
- Stored energy panel of 80 Watt second capacity
- Discharge time of 0.0008 to 0.0012 second
- Permits welding of difficult materials . . . copper, silver, tungsten, etc.
- Reliable welds without discoloration, deformation, metallurgical change
- Welding head interchangeable for increased pressure (TW3 head), or for hard-to-get-to assemblies (Plier type electrode)

**Complete line of bench heads and controls available for varied purposes**

FEDERAL TOOL ENGINEERING CO.
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Cedar Grove, New Jersey

**Circle No. 43 on Reader Service Card.**



## Orange Welding Cable

A new type of safety-colored welding cable said to be superior in resisting abrasion, oils and solvents, ozone, and other corrosive elements, has been announced by Carol Cable Company. Called VU-TRON 7, it withstands abrasion twice as well as chloroprene and five times better than synthetic rubber after a period of oil immersion. Following 3000 hours of exposure to ozone at 100°F, VU-TRON 7, unlike rubber, showed no cracks—and its volume swell proved negligible in comparison with other cables. Its bright orange color permits easy identification.

**Circle No. 31 on Reader Service Card.**

## Structural Tubing

A wide range of sizes of square and rectangular hot rolled carbon steel hollow structural tubing made to structural steel specifications have been unveiled by U. S. Steel's National Tube Division.

A building can be erected 30% to 40% lighter, but just as strong as the same structure employing conventional structural sections, and lighter framework can mean lighter footings and foundations. It can also mean reduced construction costs, lower freight charges, lower handling costs, and easier and faster field erection.

The new tubing will be produced from standard A7 and A36 structural carbon steel. The sections will be hot rolled on conventional pipe mills, in an economical, continuous operation.

Hot rolled carbon steel hollow structural tubing is now available in sizes from 1 inch square to 8 inches square, and from 3 x 2 inch rectangles to 6 x 4 inch rectangles. Larger sizes for very heavy construction will be available later.

**Circle No. 207 on Reader Service Card.**

## Polyfit Safety Glasses

Developed for jobs involving high heat or humidity, Polyfit safety glasses with side shields to provide better ventilation and cut side light re-

BREN WELD
WELDING EQUIPMENT
5114 THIRD AVENUE
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# Arc Spot Welding Gun

## *does 10 minute job in 10 seconds*

Stimmel Winch Co., Inc., Long Island City, N.Y., now welds balancing slugs on propeller shafts (used for main drives on over-the-road trucks) in place on the drive shaft balancing machine, using a Bren/Weld Model #90 Auto Arc Spot Weld Gun and a Model #90 110/220V Power Pac.

There is no before or after preparation; no welding skill, shield, or goggles are needed. Operator simply puts balancing slug on the shaft and presses nose guide of Arc Spot Weld Gun against the slug, making a satisfactory arc spot weld.

Special iron powder coated electrodes in 1/16", 5/64", and 3/32" diameters are used with the Arc Spot Gun.

Propeller shafts vary in wall thickness from .188" to .065"; slug weights used are about the same.

Balancing had been done by taping slugs onto the shaft, removing it from the balancing machine and welding with stick electrodes. Time was about 10 minutes.

**For More Information Circle No. 28 on Reader Service Card.**

flection have been announced by Chicago Eye Shield Company. Plastic bound side shields have black oxidized screen, fine or coarse mesh. Other features include extra rugged Polyfit nose bridge that fits 90% of all workers Rhodium-plated temples, welded hinges with Sur-Lok pins. Temples are available with vinyl-coated cable or spatula ends.

**Circle No. 208 on Reader Service Card.**

### New MiniArc

New low-cost arc welding equipment for a variety of difficult fabrication and reclamation jobs features very-small-diameter electrode wire and uses inexpensive carbon dioxide or argon and helium. It has been introduced by the National Cylinder Gas Division of Chemetron Corporation.

The semi-automatic "MiniArc" equipment is said to weld light-gage metals in any position, be fast in operation, and eliminate much clean-up time because it reduces spatter. MiniArc equipment consists of an AM-8 torch, WC-5 control with wire drive, interconnecting gas and flexible conduit assemblies. The unit, only 12¼ by 16 by 20 inches, has a wire feed rate from 55 to 500 inches per minute. Wire sizes are .025 .300, and .035 inches.

**Circle No. 209 on Reader Service Card.**

### Stress Relieving and Welding Machine

A compact, portable machine that can be used to stress relieve up to 2 welds at one time and to do a.c./d.c. welding has been introduced by Electric Arc, Inc. Two basic models of the UniPak are being produced: One equipped with six individual UniPak resistance heating units, the other with three units. The UniPak is designed for use with Electric Arc's HiTemp clamp-on resistance heater, E. A. I. Radiant HeatKoils, or any Falcon-type high voltage resistance heater with slight modification.

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**Circle No. 53 on Reader Service Card.**

"What's the secret of your strength, HERCULES?
"No secret – I use only virgin alloys in my spotwelding tips and machine them with the best equipment money can buy."

Resistance Welding Alloys our only product. An abundant inventory of spotwelding tips and related accessories, as well as the various grades of copper-alloy bar stock, maintained at all times.



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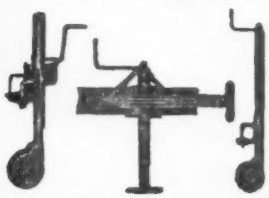

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HAMMER BLOW TOOL CO.

WAUSAU • WISCONSIN

Circle No. 48 on Reader Service Card.




### New Aluminum-Winding Process

A new process for producing an extremely clean and perfectly level layer wound aluminum welding wire has been developed by American Brazing Alloys Corp. This new process provides the operator with a minimum of downtime and the optimum of production in aluminum welding. The aluminum welding wire will be processed in 1-, 10-, and 20-pound spools.

**Circle No. 211 on Reader Service Card.**

### Single Phase Mig Welder

A 200 amp d.c. constant voltage power supply for Mig welding operates on single-phase lines. It is available from Glenn Pacific Corporation. Special Glenn circuitry provides characteristics ideally suited to Mig welding steel, aluminum, or alloys, including the entire "short arc" range and the lower end of the "spray arc" range. Designated Model CV200, the unit has a rated output of 200 amperes at 35 vdc, 100% duty cycle. Open circuit output voltage range is 8.5 to 53 vdc on 230/460 volts input. Low input requirements (17 amps at 460 volts or 34 at 230, rated load) mean inexpensive installation.

**Circle No. 212 on Reader Service Card.**

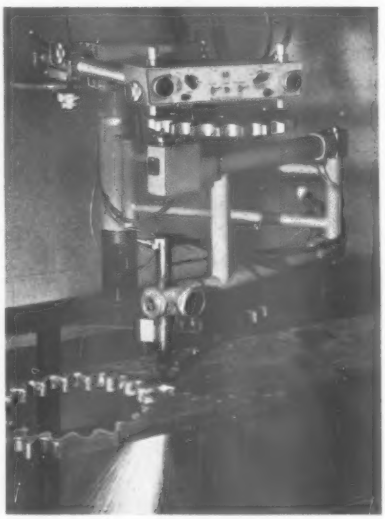
### Agglomerated Flux

A new agglomerated alloy flux for submerged arc fabricating and rebuilding of 12-15 percent manganese steel parts has been announced by the Lincoln Electric Company. Lincolnweld M-210 flux reduces material costs and increases deposition rates and welding speeds. Physical properties are: yield strength, 64,400 psi; ultimate strength, 107,500 psi; and elongation in 2 inches of 35 percent. Typical deposition is 16.2 pounds an hour at 100 percent operating factor. Deposits have an 11-19 Rockwell C hardness rating and can be machined, and will surface harden to 48 to 53 Rockwell C.

**Circle No. 213 on Reader Service Card.**


*with a Heath Ultra-Graph*

**Make a new set of teeth in minutes**



It takes six minutes to flame cut a sprocket. In that six minutes nineteen teeth with smooth finishes are formed—and for very little.

The cost of each sprocket is low because operating costs are low. With automatic torch lighter and valve manifold the Ultra-Graph lets the operator shut off the torch after each cut to save gas. A press of a button relights the torch without readjustment. Once cutting begins the operator is free to clean and prepare for the next cut. It's simple and easy. Send now for more information.

HEATH ENGINEERING COMPANY

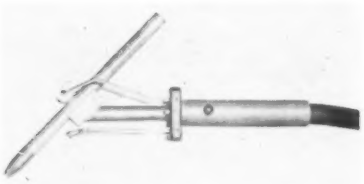
P. O. BOX 821
FORT COLLINS, COLORADO

Circle No. 52 on Reader Service Card.

### Ripper Point Recaps

Forged steel Ateco Recaps for rebuilding all popular makes of ripper points are now available from American Tractor Equipment Corp. Drop forged from a special high-strength alloy steel and heat treated to 500 Brinnell hardness, Ateco Recaps are said to out-dig and out-wear original points by as much as 4 to 1. Install them by welding along prechamfered edges.

**Circle No. 214 on Reader Service Card.**



### Metal Removal Torch

Model "V" metal removal torch for cutting, gouging, and beveling all types of metal has been announced by Arcair Co. It is designed primarily for pad washing in steel and alloy foundries. It can also be used in exterior fin and other sprue removal and on any heavy duty metal removal application. The Model "V" features a spring steel wire guard surrounding the head to prevent accidental arcing. The air supply is controlled by a push-button air valve. Available for use with ½, ⅝, or ¾ inch electrodes. Current requirements vary from 400 to 1600 amps.

**Circle No. 215 on Reader Service Card.**

### Wide-Vision Welding Helmet

A new Fiberglas wide vision welding helmet has been announced by the Fibre - Metal Products Company. Designated No. 880, the new helmet is light in weight (22 ounces and has 4½ by 5¼ inch lens for maximum vision. Standard features are a new plastic headgear (No. 3-C), ratchet headsize adjustment, overhead depth adjustment, free float suspension joint arms; and all aluminum parts for light weight and resistance to corrosion. Friction joints provide adjustment for lowering and raising of the helmet as desired.

**Circle No. 44 on Reader Service Card.**


**Circle No. 26 on Reader Service Card.**

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for use in

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KEEN-CUTS—for the best characteristics of carbon and graphite in a carbon arc cutting electrode. Higher current capacity ... longer life ... shorter cutting time ... greater material removal ... smooth surface gouge ... controllable accuracy ... hot stable cutting arc ... elimination of smoke and gases.

And they're low in cost. Try BECKER KEEN-CUT ELECTRODES—black or copper coated, standard diameters, 12" lengths in 150 to 1400 amp. range—for the most efficient, labor-saving electrode in carbon arc/compressed air cutting.

A COMPLETE LINE OF CARBON AND GRAPHITE WELDING SUPPLIES—carbon and graphite electrodes, carbon rods and plates, welding paste, graphite cores and chills, graphite powder and particles of any mesh.

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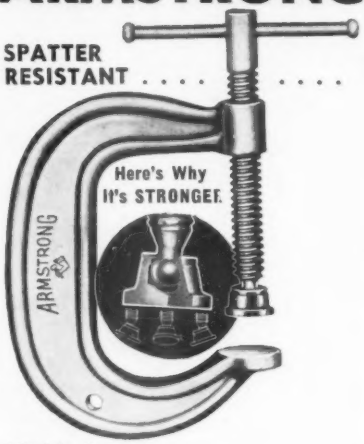
SPATTER RESISTANT . . . .




Welder's
**C-CLAMP with the New Ball-joint Swivel Pad**
***that can't come off***

These finest welder's clamps have every quality and convenience feature: Extra deep throat. Extra stiffness and strength—drop forged steel, heat treated. Cadmium plated *all over*—spatter resistant. Drilled for ground. And, the exclusive, ARMSTRONG 1-piece, formed-on swivel pad that can't work, pry or knock off. 8 sizes: capacities to 12" opening. Specify ARMSTRONG Spatter Resistant Welder's "C" Clamps for safe, lifetime service. There are no better.

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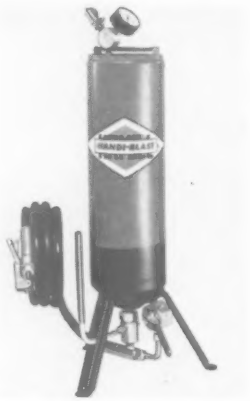
**5262 West Armstrong Ave. • Chicago 46, Ill.**

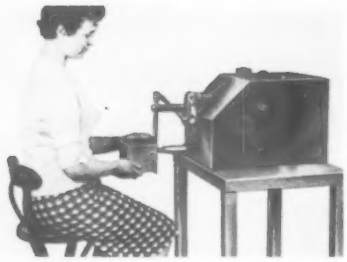
NEW PRODUCTS *continued*



## Portable Sandblaster

A new Handi-Blast portable sandblaster (Model 28A) has been introduced by Handi-Blast Division of Hamill Mfg. Co., Inc. Model 28A has been designed for fast, economical sandblasting. Constructed of ⅛ inch steel, it weighs 24 pounds empty, and can hold 28 pounds of sand. Each unit is tested at 300 p.s.i. and operates on any production spray gun hookup. Features include a squeeze grip abrasive delivery nozzle, a pressure gauge, and a pressure relief valve.

**Circle No. 220 on Reader Service Card.**



## Bench Spot Welder

A bench spot welder with six heat stages has been introduced by The North American Division of Triangle Products, Ltd. After determining weld time and tip pressure, pressing the foot pedal starts the automatic weld cycle. It will spot weld sheets from .006 inch to 16 gage and wire up to 6 gage. Features include built-in self-actuated water-flow cooling system.

**Circle No. 221 on Reader Service Card.**

## New Spot Welder

A new press-type, bench spot welder has been announced by Aro Spot Welder Corp. It is said to work equally well on rough or delicate work. Designated the ARO Model M 33 V P, this spot welder permits a wide variety of tip set-ups for handl-

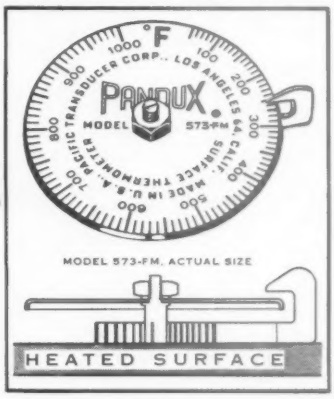
For *Accurate* WELDING HEATS...

USE THIS

PANDUX

**WELD-CHEK** ®
**THERMOMETER**

Indicates up to
**1000°F.**
Accuracy ±2%

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- **MANGANESE**
- **PRE-HEATED MAGNESIUM**
- **HARD FACING**
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ALL STAINLESS STEEL 50°F. to 1,000°F. Stability within 60 seconds . . . easy to read. May be left on material or area to be tested during pre-heating period . . . need not be removed between readings. User can reset, if necessary. Small magnetic clamp holds thermometer in place on vertical or slanting ferrous surfaces. Diameter 1¾", weight ½ oz.

Model 573-FM with Magnet Clamp **$4.00**

Model 575-FM, same but with maximum-minimum temperature indicators, $6.75

Your order will be filled through your nearest dealer

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VARIABLE TORQUE
FOR OBTAINING MAXIMUM POWER WHEN CUTTING HARDER MATERIALS
BUILT-IN LUBRICATION
PREVENTS GALLING AND PROLONGS LIFE OF PUNCH AND DIE
PATENT PENDING
BUILT-IN CIRCUIT BREAKER
PROTECTS MOTOR AND GEARS WHEN MACHINE IS OVERLOADED OR WHEN PUNCH AND DIE GET TOO DULL FOR EFFICIENT OPERATION
QUICK CHANGING PUNCH AND CARBIDE DIE AT NO EXTRA COST

**CUTS ¼" STEEL • ⅜" ALUMINUM**

The MODERN GOBBLER cuts 1/4" mild steel, 3/8" aluminum & 7/32" stainless steel. No distortion, bending or curling. Ideal for shipyards, welding shops, kitchen equipment builders, heavy duty metal fabricating shops.

MODEL SN-40 ELECTRIC - 2½ HP 15 Amp. AC-DC - Universal Motor
WEIGHT - 24 lbs. net

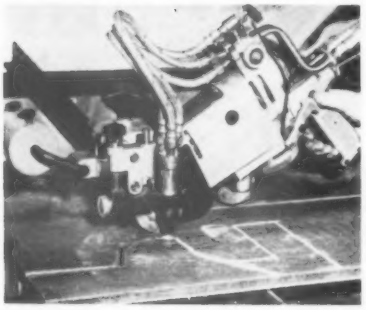
WRITE, WIRE OR CALL

**MODERN MFG. CO., INC.**
680 DAVISVILLE RD. - WILLOW GROVE, PA.
PHONE: OLdfield 9-4820

**For More Information Circle No. 81 on Reader Service Card.**

ing wide ranges of ferrous and nonferrous metals. Other features are: fingertip adjustment of welding pressure from 6 to 330 pounds, 162 current settings from 900 to 16,000 amps by vernier regulator, and fast follow-up through air and spring pressure combination.

**Circle No. 222 on Reader Service Card.**



### Flame Cutting Machine

New 19-pound flame-cutting machine, the CM-75 Cadet, has been introduced by Linde Company, Division of Union Carbide Corporation. It makes fast, clean cuts in metals ranging from light gage sheet to 2-inches thick. The Cadet is the only machine of its type or size equipped with a clutch. This allows instantaneous free-wheeling control, making it suitable for hand guided contour cutting. Straight-line cutting, bevel-cutting, circle-cutting and some contour-cutting can be done by the Cadet. It operates at speeds up to 30 ipm and can be used with acetylene, propane, or natural gas. Proper selection of cutting speed, preheat pressures, cutting oxygen pressure and torch tips is facilitated by data contained on a permanent, easy-to-read metal plate attached directly to the machine.

**Circle No. 223 on Reader Service Card.**

### Iron-Free Electrode

A new iron-free aluminum bronze arc welding wire and filler rod have been developed by Ampco Metal, Inc. specifically for overlay applications. The new composition—AMPCO-TRODE 7—is suggested for use where high hardness is not required. It meets AWS-ASTM classification E Cu A1 A-1. The material is available in bare 36" lengths for use with inert-gas, tungsten-arc welding process and in bare spooled wire for use with the inert-gas, metal-arc process.

**Circle No. 224 on Reader Service Card.**

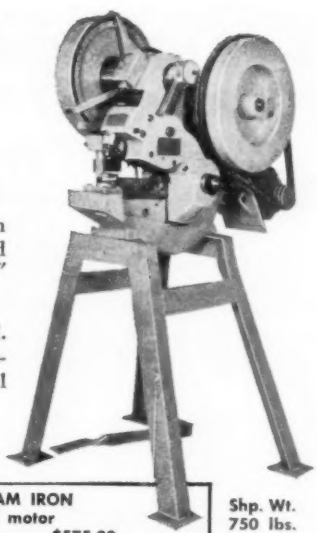

*Large and Small Fabricators of steel and ornamental iron swear by it ...*

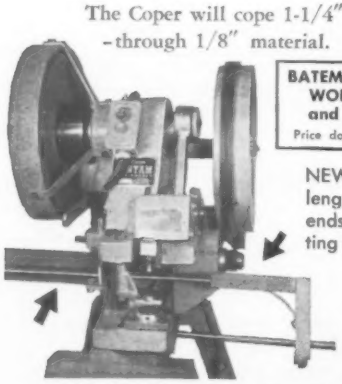
**BATEMAN BANTAM IRON WORKER**

The Bantam cuts and punches fast and clean ... no grinding necessary. It's versatile, and saves time and labor! Cuts 2" x 2" x 1/4" angle and 1/4" x 4" flats.

Punches 1/2" hole through 1/4" material. Operates by hand or foot, uses 3/4 hp motor (1750) rpm., powered with flywheel and drive gear.

The Coper will cope 1-1/4" -through 1/8" material.





BATEMAN BANTAM IRON WORKER, with motor and stand ..... $575.00
Price does not include Blades, Punches or dies.

Shp. Wt. 750 lbs.

NEW ACCESSORIES: Gauge for cutting to length, Guide for Flat Bars for cutting on ends, and Angle Iron Trimming Guide, for cutting at a 45 degree. Write for details.

WRITE TODAY for complete information and name of nearest distributor

**Bateman Foundry & Machine**
MINERAL WELLS, TEXAS

**For More Information Circle No. 24 on Reader Service Card.**



"Our weldors sure do like to work with that new Murex AC machine ..."

That's what everybody seems to be saying wherever the M&T Murex AC Industrial Arc Welder gets put on the job. No wonder. It's designed for easy handling and dependable service, with ...

Just one inch of shunt travel for entire current range. Rigidly mounted shunt for quiet, chatter-free operation. Fast, single crank heat control. Patented dual-coil transformer in a balanced circuit for smooth, steady arc under all welding conditions. High open circuit voltages for instant starting of arc with all types of electrodes.

Write for data sheet. METAL & THERMIT CORPORATION, General Offices, Rahway, New Jersey.

M-T MUREX

AC ARC WELDER

**Circle No. 75 on Reader Service Card.**

### Magnetic Ground

A magnetic welders Ground Hog that makes a positive ground to any shaped object has been developed by Magne-Cast Tool Co., Inc. Long-lasting built-in Alnico magnets hold replaceable copper contactors in any position. Aluminum body provides good conductivity.

Model A is for 600 amps, Model B for 200 amps.

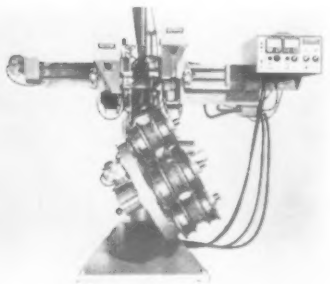
**Circle No. 225 on Reader Service Card.**

### Corrosion Inhibitor

A rust and corrosion inhibitor to protect high tensile and stainless steels from the time weld joints are prepared until they are actually welded has been developed by Special Chemicals Corp. Called Deoxaluminite, it does not have to be removed before welding. Its deoxidizing action will even make welding easier and improve joint soundness on lightly rusted steel.

Deoxaluminite also is an excellent prime for paint and subsequent coatings.

**Circle No. 226 on Reader Service Card.**



### Multiple-Spindle Roller-Idler Rebuilder

A new multi-spindle rebuilding unit, Stoody Company's Automatic Welding Systems Model MR, is said to be the only roller-idler machine with offset main spindle support arm providing minimum head adjustment from tread to flange.


"We're using M&T's new DC machine ...it's the best we've seen, and we looked..."

And if *you* look and compare, you'll concur. The Murex 3-phase DC Welder offers the type of rectifier that works best for this service; and it features a design that simplifies operation, makes life easy for the weldor.

Silicon diodes, hermetically sealed, are non-aging and give as much as 98% efficiency. Electrical circuit is designed for instant recovery voltage so that arcs are easily struck, stabilized, and maintained. Simple knob and selector make control of heat and polarity very easy.

Write for data sheet. METAL & THERMIT CORPORATION, General Offices, Rahway, New Jersey.

M&T MUREX

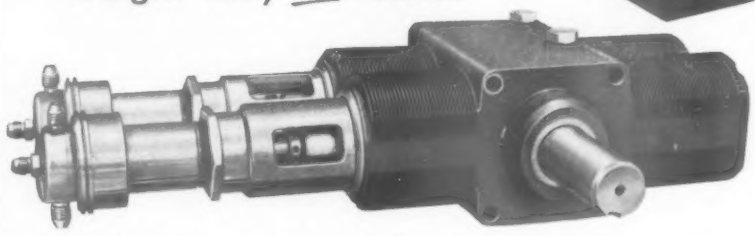
DC WELDER

**Circle No. 76 on Reader Service Card.**

NEW HIGH PRESSURE LIQUID OXYGEN PUMP

Weighs Only 60 Pounds

Outperforms Pumps Ten Times Its Weight



**Pressures:** To 15,000 PSI
**Cool-down time:** 5 minutes or less
**Servicing time:** 15 minutes–1 man maintenance
**Insulation:** None required on lines or pump
**Flow Rate:** 2000 scfh to 75,000 scfh of liquid gas to gaseous gas using ambient air or water vaporizers.
**Suction Head Requirement:** Below 20 psig at flows of 30,000 scfh at 3,000 psig discharge pressure.
**Drive:** Electric motor-driven pump close-coupled to motor. No alignment between pump and motor necessary.

- Minimum components.
- All pumps tested with liquefied gas before shipment.

Here's a reliable high-pressure LOX pump weighing only 60 pounds and so compact that it occupies only one-quarter the space of other high-pressure pumps designed for equivalent work loads. A fantastically short cool-down time and ease of servicing make it ideal for use in ground support equipment or wherever it is necessary to handle low boiling point liquefied gases such as oxygen, argon, hydrogen and nitrogen.

No complicated parts . . . no external support equipment such as lubrication pumps, coolers, fans, etc. . . . this pump is so simple it can be disassembled, serviced and reassembled in 15 minutes by non-technical personnel. Building block assemblies of from one to five modular elements fit a wide range of requirements. Units are immediately available.

**Free!**

New 64 page catalog. The largest line of low temperature equipment available. Also valuable cryogenic information.

hofman LABORATORIES, INC.

5 Evans Terminal, Hillside 5, N. J., ELizabeth 4-4016

**For More Information Circle No. 55 on Reader Service Card.**

Other operating features include a columnized, easy-to-operate electronic control panel; full welding heads; wire straighteners; maintenance-free flux valves and shutoff mechanisms; and a rugged carriage assembly that is engaged for directional travel by a simple 3-position lever.

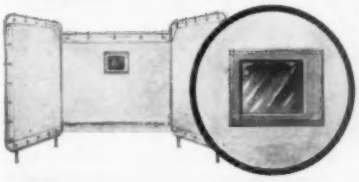
This unit can be used with layer wound coils or economical 500-pound Payoffpaks. System includes two 500 amp constant voltage, 100% duty cycle power sources.

**Circle No. 227 on Reader Service Card.**

### Three New Styles of Welding Hand Shields

Three new styles of welding hand shields have been added to the safety products line of the American Optical Company's Safety Products Division. The division now has a complete line of welding hand shields. One of the new shields is a curved-chin style, dark grey fiber glass protector. Another is a narrow shell-style with flanges on the sides, top and bottom. The third is a straight bib style which offers added protection to the neck and chest areas. All three new shields have a light-weight aluminum glass holder and a straight handle of formed fiber.

**Circle No. 228 on Reader Service Card.**



### Window For Welding Screens

Portable screens with a glass welding plate for safe outside viewing of the welding operation have been introduced by Singer Glove Mfg. Co. Can be used for inspection or checking, training, or for visitors. The plate, filter shade #10, is easily removed from its leather reinforced pocket. It is available in screens 6 to 8 feet high, in either triple or 4-sided models.

**Circle No. 229 on Reader Service Card.**

**WELDERS--YOUR EYES DESERVE THE BEST!**

ONLY THERMO GROUND and POLISHED FILTER PLATES CAN GIVE YOU 100% UNIMPAIRED VISION

There is no substitute for a Thermo Optically Ground and Polished Filter Plate which is carefully graded and selected to insure you a sharp definition and eliminate fatigue.

The restful soft green shade gives you maximum reduction of eye strain.

*Always protect your Thermo Filter Plate with a Sta-Kleer All-Plastic long-life cover lens.*

THERMACOTE Company

108 SOUTH DE LACEY AVENUE • PASADENA, CALIF.

**For More Information Circle No. 100 on Reader Service Card.**

"I hear the Muretran* welder can handle any type of welding... man, is it engineered!"

Word gets around fast. M&T's "Muretran" Welder is the most versatile ever developed for its field of application. Look at this array of features:

Suitable for manual, automatic, inert gas (MIG, TIG), and spot welding—with quick changeover from one to the other. Plug-in timers for gas pre-flow, post-flow, high frequency drop-out, spot arc. Patented, dual windings in saturable shunt transformer. Sealed non-aging silicon rectifiers for highest efficiency. Want to hear more about M&T's welders?

Write for data on AC-DC and AC units. METAL & THERMIT CORPORATION, General Offices, Rahway, New Jersey.

*Trademark

M&T MUREX

MURETRAN All-Purpose WELDER

**Circle No. 77 on Reader Service Card.**

# SPECIAL MONEY-SAVING OFFER!

**For Light Welding & Cutting:**

**NEW PUROX 100 ONE HUNDRED OUTFIT**

**$114.62 value for only $100.00**

**YOU SAVE $14.62!**

Ideal for light-duty production, repair, maintenance work. Use the PUROX "100" oxy-acetylene outfit on aircraft, small parts, light machinery, sheet metal assemblies. Pocket-sized regulators and compact torch make it extra small, portable (entire unit weighs less than 10 lbs.). Welds up to 3/8", cuts up to 2". Additional heads and nozzles available to extend range. Elimination of metal-to-metal gas seals adds years of useful life.

**For Medium Welding & Cutting:**

**NEW PUROX 130 ONE-THIRTY OUTFIT**

**$148.07 value for only $130.00**

**YOU SAVE $18.07!**

Meets any shop's medium-range oxy-acetylene needs . . . on production lines, in garages and repair facilities, on pipe welding jobs, in tool, die, maintenance departments. *Easy to use*—no need to re-adjust regulators when you switch jobs. *Reliable*—flame won't sputter or pop regardless of size, valve-throttle or regulator settings. Lightweight, easily portable, economical to buy and use. Welds up to 3/8", cuts up to 4".

Your LINDE Distributor — Where One Call Gets It All

Your nearby LINDE distributor has both these PUROX kits in stock now. For his location, check your Yellow Pages or write Linde Company, Division of Union Carbide Corporation, 270 Park Ave., New York 17, N. Y. *In Canada:* Union Carbide Canada Limited, Linde Gases Division, Toronto 12.

**LINDE COMPANY**

**UNION CARBIDE**

"Linde," "Purox," and "Union Carbide" are registered trade marks of Union Carbide Corporation.

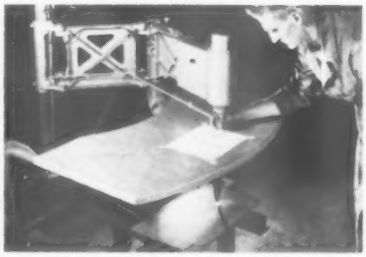
**For More Information Circle No. 66 on Reader Service Card.**




## Spray-on Temperature Indicating

Eight new ratings of Tempilaq in aerosol cans have just been added to the line of temperature indicating coatings by Tempil Corp. The new Tempilaqs cover the 650 F to 1000 F interval. This makes 44 systematically spaced temperature ratings presently available in aerosol form—spanning the range 100 F to 1000 F Tempilaqs for temperatures above 1000 F are presently available in standard glass bottle packaging only.

**Circle No. 230 on Reader Service Card.**



## Flame Cutting

The Gloor flame cutting machine introduced by Earth Equipment Corp. is said to solve a wide variety of engineering and manufacturing problems. Named the Expeditor, it occupies a floor space of only 39-by-36 inches, and weighs 203 pounds. It cuts plate from 1/8-inch to 4-inches-thick. Controls include: fingertip tracing and duplicating of any rough sketch or precision blueprint, duplication of a metal part, magnetic automatic duplication of a template, and automatic control for straight and circular cutting.

**Circle No. 37 on Reader Service Card.**

## Two New Spoolarcs

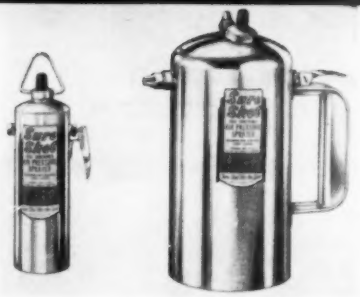
High quality deoxidized copper and aluminum bronze have been added to the layer-level wound Spoolarc metals for Mig welding, by All-State Welding Alloys Co., Inc.

Deoxidized copper can be used for joining copper to mild steel or to copper and bronze alloys. It is free-flowing and produces strong ductile

welds which maintain a relatively high electrical conductivity.

Aluminum bronze applications include the joining of bronze to copper or low alloy and carbon steel to stainless. It can also be used for surfacing.

**Circle No. 231 on Reader Service Card.**



### Portable Arc Welder

A full 125 ampere portable arc welder that weighs only 45 pounds and measures 12 x 16 x 9 inches is being marketed by Bren/Weld Sales, Inc. The design of this Bren/Weld Model 125W permits its use in many small production applications. It will weld anything from light sheet metal to ½" plate. Welding range is from 25 to 125 amperes in 12 heat stages. The unit operates from any 115 to 230 volt a.c. line, with 75 volts open circuit for easy arc starting.

**Circle No. 232 on Reader Service Card.**

### Sprayers for Anti-Spatter

Sure Shot portable sprayers that cut application time, provide a more uniform coating, and economize on anti-spatter compound have been developed by Milwaukee Sprayer Mfg. Company. The handy Sure Shot sprayers—air-charged by standard compressed air or auxiliary carbon dioxide bombs—dispense anti-spatter compound and other light liquids in a jet stream or fine mist spray. Two sizes are available.

**Circle No. 233 on Reader Service Card.**

### Spray-Rod Surfacing

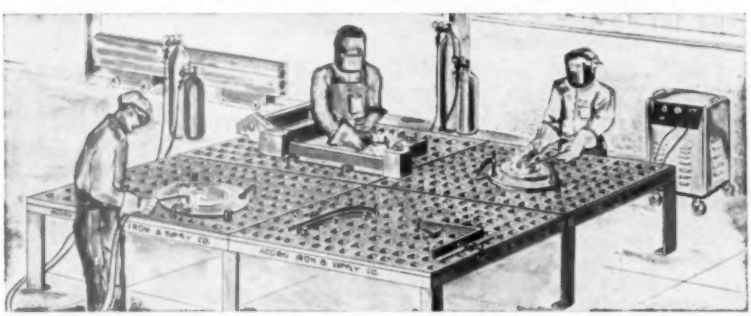
Stulz Spray-Rod is an a.c.-d.c spray-on rod developed by Stulz-Sickles Co. for thin-layer hardfacing. It goes on fast, applying a hard, smooth skin for protection of all steels against abrasion. It is recommended for edge-facing where section is important.

**Circle No. 234 on Reader Service Card.**


*for research, design, and development . . . metal fabrication, maintenance and plant engineering*

## Layout and Set-Up Blocks or Welding Platens

**BENDING BLOCKS • BED PLATES • SURFACE PLATES • FLOOR PLATES**



Each ACORN Bending Block or Welding Platen has 1¾" square holes, 3½" center-to-center, for clamping, dogging or spacing. Working surfaces and side edges are machined within .005" of flatness. Blocks are semisteel castings with 30,000 to 32,000 psi tensile strength. A wide variety of accessories are also available.

**WRITE TODAY FOR COMPLETE LITERATURE**

Used singly or in multiple groupings ACORN Welding Platens or Bending Blocks are standard equipment in many shipyards, railroads, pipe and steel fabricators, welding shops, research laboratories, and wherever metal is formed, shaped or welded.

**MODELS**

**These models are in stock:**

| | |
|---|---|
| 2650 | 2'6" x 5' |
| 4040 | 4' x 4' |
| 5050 | 5' x 5' |
| 5060 | 5' x 6' |
| 5080 | 5' x 8' |
| 9610 | 3'6" x 10' |

**ACORN**
**IRON & SUPPLY CO.**
Delaware Avenue at Poplar Street
Philadelphia 23, Pennsylvania

**For More Information Circle No. 7 on Reader Service Card.**

## —your LINDE distributor!

It takes more than a line of welding equipment to be a LINDE distributor. It takes real knowledge of your welding needs . . . knowledge of local industry . . . practical experience and interest in efficient welding operations . . .

These are some of the qualifications that make your LINDE distributor so valuable to your business. He's a specialist in his field, equipped with a complete stock of welding and cutting equipment, industrial gases, welding rods, supplies, and accessories. They're all products of highest quality and proved efficiency. Your LINDE distributor is ready to help you today, with equipment, expert advice, and the benefits of LINDE's 50-odd years of welding and cutting leadership.

**A telephone call will prove the point.** Look up your LINDE distributor in the classified directory. Or write to Linde Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, New York. *In Canada,* Union Carbide Canada Limited, Linde Gases Division, Toronto 12.

Your LINDE Distributor

***"Where One Call Gets It All"***

**LINDE COMPANY** UNION CARBIDE

"Linde" and "Union Carbide" are registered trade marks of Union Carbide Corporation.

**Circle No. 67 on Reader Service Card.**

Circle No. 14 on Reader Service Card.

COLUMBIA TORCHES

Air-Cooled and Water-Cooled for Inert Gas Shielded Welding

Type 2WL-7

As pioneers in all-brazed torch construction, we have developed products that are easy to use and maintain, give full gas shielding, and have minimum electrode stub loss.

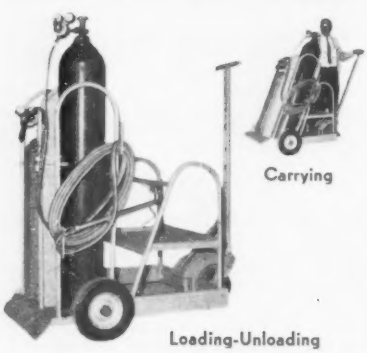
**TYPE 2WL-7** water-cooled torch (shown) is made from a brass forging designed for a current rating of 350 amps on a 100% duty cycle; brazed construction.

**TYPE 2WH-7** water-cooled torch is for heavy duty welding requiring currents up to 500 amps, 100% duty cycle. Head is machined from brass forging, forming foundation for an all-brazed torch.

**4AG-7** air-cooled torch can use up to 7" electrode. Long and short cap let operator change for low clearance jobs. Ampere rating is 150 on 60% duty cycle.

**AMERICAN**
**ELECTRIC & MACHINE CO., INC.**
405 Cedar Lane Teaneck, N. J.

**SMITH-BYRD**
***Cylinder Carts Are SAFE***



Carrying

Loading-Unloading

Three wheel design provides stability; eliminates danger of dropped cylinders.

- Nothing to support but the handle
- Low center of gravity
- Pulled from front; can be towed
- Pivoted cylinder cradle
- Steel fire wall between cylinders
- Rubber tire wheels with anti-friction bearings
- Tool shelf and rod-holding rack
- Swiveled front wheel

**SMITH-BYRD CO., INC.**
1968 Tuxedo Ave., N.E., Atlanta 7, Ga.
**Circle No. 95 on Reader Service Card.**

## NEWS BRIEFS

**A HARDSURFACING SEMINAR** for representatives of the United States Corps of Engineers was held at its Cleveland, Ohio, plant by the Lincoln Electric Co. Ten district engineers attended the one day program. A. F. Boucher, Lincoln's general sales manager, was chairman.

**A $1-MILLION EXPANSION PROGRAM** which will gear the Nooter Corporation, St. Louis, to the growing needs of the nuclear age and boost its employment by 10 percent has been announced by Robert J. Ryan, president.

**THE DESIGN AND FABRICATION** of two ultra-high vacuum test chamber systems and one roughing pump system for the NASA has been completed by the Nucledyne Division, Cook Electric Co., Chicago.

**DEPARTMENT OF THE NAVY** (Yards and Docks) has awarded a contract to Dalweld, Inc., Mt. Vernon, N. Y. The contract calls for supplying the company's Phos Sil 15 brazing alloy to Naval shipyards throughout the country and in Pearl Harbor.

**THE ATOMIC ENERGY COMMISSION** has awarded a $415,000 contract to Babcock & Wilcox Company for the design and fabrication of a second head, or top closure, for the reactor in the N. S. Savannah, the world's first nuclear merchant ship.

**A DUAL-PURPOSE ON-SITE** air separation plant will be built at Texas Instruments, Inc., Dallas, by the National Cylinder Gas Division of Chemetron Corp. The plant, which will cost more than a million dollars, will have capacity to produce 120 tons per day of oxygen, nitrogen, and argon.

**THE LONGEST NITROGEN PIPELINE** in the United States will soon bring high purity nitrogen in large quantities to plants in the rapidly expanding Delaware Valley chemical complex. The pipeline will be more than 22 miles long, originating at Air Reduction Sales Company's 6½-million air separation plant now under construction on a 9-acre site at Claymont, Delaware, and crossing the Delaware River into New Jersey.

**"A MAINTENANCE WELDORS' CLUB"** has been organized nationally by Eutectic Welding Alloys Corp., which is also sponsoring regional clubs. Purpose of the clubs is to make available to those people interested in maintenance welding specialized information on maintenance welding techniques and equipment. Information can be obtained from J. G. Magrath of Eutectic, at 40-40 172nd Street, Flushing 58, New York.

**THE ARMY ORDNANCE CORPS** has given a contract to American Brazing Alloys Corp., Pelham, New York. The contract calls for the supplying of silver solder to Picatinny Arsenal, New Jersey.

**SECOND ANNUAL WELDING INSTITUTE** for high school welding instructors will be held at the University of Wisconsin and the Madison Vocational School on Saturday, October 21. It is being sponsored by the Madison-Beloit AWS Section, the University of Wisconsin, and the Madison Vocational School.

# Data Offered in This Month's Ads

*Readers may obtain any of these free reference materials by circling the corresponding numbers on the Reader Service Cards*

**1: Hard surfacing electrodes** and wires are listed in a catalog. McKay Co.

**2: Electrodes** for welding mild steel are described in a catalog. McKay Co.

**3: Welding of stainless** steels is described in a catalog. McKay Co.

**4: Micro-Matic rebuilder** is featured in bulletin MI-402. McKay Co.

**5: Track-O-Matic** automatic rail rebuilder is described in bulletin TR-302. McKay Co.

**6: Multi-Matic** universal rebuilder is featured in bulletin MU-502. McKay Co.

**7: Welding platens** are described in literature. Acorn Iron & Supply Co.

**8: Welding electrodes** for 100 different jobs can be recommended by your Airco distributor. Air Reduction Sales Co.

**9: Stainless welding wires** are featured. Air Reduction Sales Co.

**10: Jet flux** folder is offered. All-State Welding Alloys Co., Inc.

**11: Metal cutting** is explained in Bulletin DH-106. Allison Campbell Division, American Chain & Cable Co., Inc.

**13: Brazing alloys** are listed in a catalog. American Brazing Alloys Corp.

**15: Eye and head safety** equipment is featured in a catalog. American Optical Co.

**16: Low temperature silver brazing** is the subject of a booklet. American Platinum & Silver Division of Engelhard Industries, Inc.

**17: Beveler** is featured in literature. American Pullmax Co., Inc.

**19: Surfacing electrodes** are the subject of Bulletin W-17. Ampco Metal, Inc.

**20: Fluxes** for welding and brazing are listed. Anti-Borax Compound Co., Inc.

**21: Hold down clamps** are featured. Armstrong Bros. Tool Co.

**22: Welding positioners and manipulators** are featured in literature. Aronson Machine Co., Inc.

**23: Welding accessories** are featured. Atlas Welding Accessories Inc.

**24: Iron workers** and accessories are described in literature. Bateman Foundry & Machine Co.

**25: Abrasive cutting machines** are listed in a catalog. Beaver Pipe Tools, Inc.

**26: Carbon arc gouging** is featured in material. Becker Brothers Carbon Co.

**28: Arc spot welding** equipment is featured. Bren Weld Corp.

**30: Power connectors** are described in catalog. Cam-Lok Div., Empire Products, Inc.

**31: Welding cable** is featured. Carol Cable Company

**32: Welding helmets** are described in literature. Chicago Eye Shield Co.

**33: Chipping hammers** are described in a bulletin. Chicago Mfg. & Distributing Co.

**34: Blowtorches** are featured in literature. Clements Mfg. Co.

**35: Shears** are described in catalog No. 2011. Cleveland Crane & Engineering Co.

**36: Pipe layout equipment** is featured. Contour Sales Corp.

**37: Automatic flame cutting** is featured. Earth Equipment Corp.

**38: Spot welding tips** and equipment are shown. Eisler Engineering Co., Inc.

**42: Controlled angle torch** for tungsten inert gas arc welding is described in catalog. Falstrom Co.

**43: Precision resistance welding equipment** is featured. Federal Tool Engineering Co.

**44: Welding helmets** are described. Fibre-Metal Products Co.

**45: Galvanizing** small parts and weldments is described in data. Galv-Weld Products

**46: Brazing flux** and its characteristics are explained. Goldsmith Bros.

**47: High strength steel** specifications are contained in a brochure. Great Lakes Steel

**48: Axles, jacks,** and couplers are featured in a catalog. Hammer Blow Tool Co.

**49: Silver brazing** data is contained in bulletin 20. Handy & Harman

## OFFERED FOR THE FIRST TIME . . .

***The services and reference materials listed here are being offered for the first time in this issue by new WD&F advertisers.***

**14: Welding torches** for gas shielded arc welding are featured in literature. American Electric & Machine Co., Inc.

**18: Reinforced branch connections** for carbon steel and alloy are featured. Bonney Forge and Tool Works.

**27: Water cooling** for welding equipment is the subject of a booklet. Bernard Welding Equipment Co.

**29: Depressed center grinding wheel** and right angle grinder are featured in Literature. Brunmar Commercial Corp.

**41: Unique combination of facilities** for design and fabrication are described in a catalog. Erie Strayer

**95: Safe cylinder cart** is described in literature. Smith-Byrd Co., Inc.

**103: Facilities for welded fabrication** are featured. John Van Range Co.

**106: Welding time recording device** is described in literature. Weld-Record Corp.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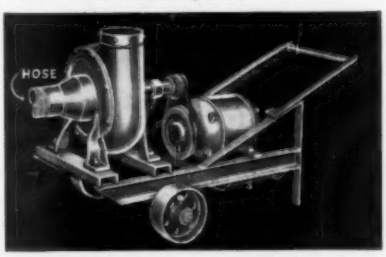


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**51: Gageless regulators** are described. **Harris Calorific Co.**

**52: Controlled flame cutting** is described in literature. **Heath Engineering Co.**

**53: Resistance welding alloys** and tips are featured. **Hercules Welding Products**

**54: Multi-wire** for automatic wire feed welding processes is described in literature. **Hobart Brothers Co.**

**55: Cryogenic equipment** and information are featured. **Hofman Laboratories, Inc.**

**57: Flux recovery** is the subject of a folder. **Invincible Vacuum Cleaner Mfg. Co.**

**58: Electrode holders** are described and illustrated. **Jackson Products**

**60: Band saws** for all metal cutting are listed in a catalog. **Johnson Mfg. Co.**

**63: Welding symbols** chart is offered. **Lenco, Inc.**

**64: King size facilities** are described in literature. **Lewis Welding & Engineering Co.**

**65: Welders for light fabricating** are featured. **Lincoln Electric Co.**

**66: Oxy-acetylene** outfits are on special offer. **Linde Co.**

**67: Welding distributors** and how they serve local needs are described. **Linde Co.**

**69: Plasmarc weld surfacing** is described. **Linde Co.**

**70: Non-destructive testing** is described. **Magnaflux Corp.**

**71: Dye penetrant materials** in spray cans are described. **Magnaflux Corp.**

**72: Facilities, capacities,** and new fabricating techniques are featured. **R. C. Mahon**

**73: News and tips** on resistance welding are offered. **P. R. Mallory & Co., Inc.**

**74: Material handling** devices are listed in a catalog. **Merrill Brothers**

**75: Murex a.c.** industrial arc welder is described in data sheet. **Metal & Thermit**

**76: Murex 3-phase d.c.** welder is described in data sheet. **Metal & Thermit**

**77: Murex Muretran welder** is described in a data sheet. **Metal & Thermit**

**78: Rebuilding and salvaging** is described. **Metallizing Company of America**

**79: Flame spraying** hardfacing is described in a bulletin. **Metco, Inc.**

**80: "Rectifiers for welding"** is a pamphlet offered. **Miller Electric Mfg. Co.**

**81: New gobbler** is described. **Modern Manufacturing Co., Inc.**

**82: Nationally known** facilities, experience, and craftmanship are described in literature. **Morgan Engineering Co.**

**83: Personal protective equipment** is featured. **National Cylinder Gas Div., of Chemetron Corp.**

**84: Saucer shaped reinforced wheels** with disposable mounts are described in literature. **Norton Abrasives**

**86: Temperature indicator** for weld heat up to 1000°F is illustrated. **Pacific Transducer Corp.**

**87: Electrode ovens** are the subject of a folder. **Phoenix Products Co.**

**88: Welding fixtures** and equipment is described. **Progressive Welder & Machine Co.**

**89: Rebuilding** worn parts is featured. **Rexarc, Inc.**

**90: Backing rings** for pipe welding are featured. **Robvon Backing Ring Co.**

**91: Portable fume collectors** are described in a brochure. **Ruemelin Mfg. Co.**

**92: Power hacksaws** are featured. **Sales Service Manufacturing Co.**

**93: Safety screens,** gloves, and safety clothing are featured in a catalog. **Singer Glove Mfg. Co.**

**94: Welding electrodes** are featured. **A. O. Smith Corp.**

**96: Fabrications** of all sizes are described in a brochure. **Steel Fabricators Co.**

**97: Hard facing** is featured in literature. **Stoody Company**

**98: Repair** of worn equipment parts is featured in literature. **Stulz-Sickles Co.**

**99: Temperature indicators** are featured. **Tempil Corp.**

**100: Lens covers** of plastic are featured. **Thermacote Co.**

**101: Gloves and garments** for welding are described. **John Tillman & Co.**

**102: Resistance welding electrodes** are listed in a catalog. **Tipaloy, Inc.**

**104: AC-DC 3-phase arc welder** is featured. **Vickers, Inc.**

**105: Welding and cutting unit** is featured in data sheet. **Victor Equipment Co.**

**107: X-ray unit** for panoramic shots is described in literature. **Westinghouse X-ray**

**108: New welding system** is described in literature. **Westing-Arc Dept., Westinghouse Electric Corp.**

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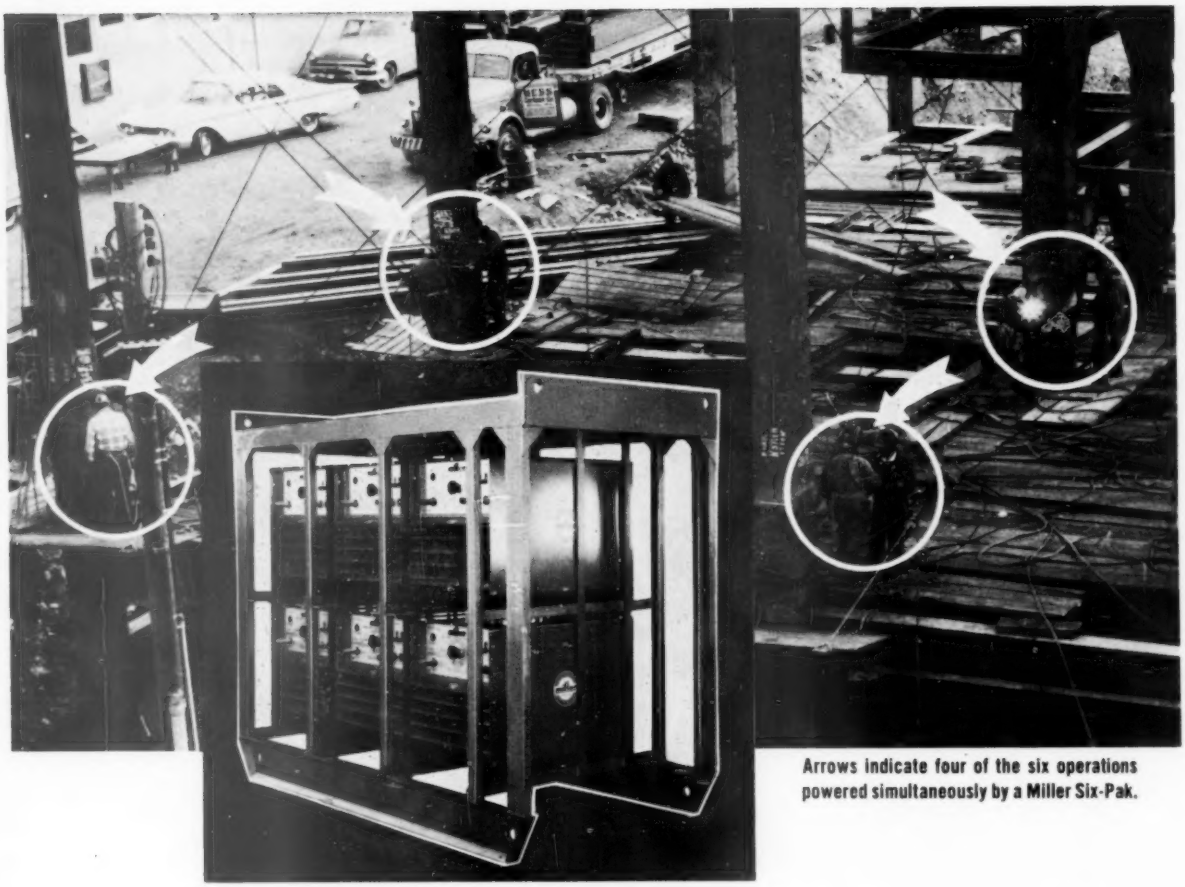

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